DEVELOPMENT OF DEMENTIA SCREENING INSTRUMENT FOR TAMIL SPEAKING PATIENTS AT SREE MOOKAMBIKA INSTITUE OF MEDICAL SCIENCES - A CROSS SECTIONAL STUDY

Dissertation

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M.D. GENERAL MEDICINE

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CERTIFICATE

This is to certify that this dissertation entitled "**Development of Dementia Screening Instrument for Tamil Speaking Patients at Sree Mookambika Institue of Medical Sciences - A cross sectional study"** is a bonafide record of the work done by **Dr. Basavaraj Shivappa Kumbar** during the period 2016-2019. This has been submitted in the partial fulfillment of the award of **M.D. Degree in General Medicine [Branch-I]** by the Tamilnadu Dr. MGR Medical University Chennai.

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I Dr. **Dr. Basavaraj Shivappa Kumbar** hereby submit the dissertation titled "**Development of Dementia Screening Instrument for Tamil Speaking Patients at Sree Mookambika Institute of Medical Sciences - A cross sectional study"** done in partial fulfillment for the award of the in Sree Mookambika Institute of Medical Sciences, Kulasekhram. This is an original work done by me under the guidance and supervision of Dr. S. Thilagar and Dr. Robert Mathew.

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ABBREVIATIONS

MMSE	-	Mini Mental State Examination
MOCA	-	Montreal cognitive assessment
ACE	-	Addenbroke's cognitive examination
DSM	-	Diagnostic and statistical manual of mental disorders
MCI	-	Mild cognitive impairment
AAMI	-	Age associated mental impairment
IVD	-	Ischemic vascular dementia
MID	-	Mild infarct dementia
DLB	-	Dementia with Lewy bodies
MID	-	Mild infarct dementia
PDD	-	Parkinson's disease dementia
LVD	-	Large vessel dementia
SVD	-	Small vessel dementia
CADASIL	-	Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy
PCNSA	-	Primary angitis/ arteritis of the central nervous system.
FMD	-	Fibromuscular dementia
CAA	-	Cerebral amyloid angiopathy
Anti ph	-	Anti phospholipid
SID	-	Strategic infarct dementia
ACA	-	Anterior cerebral artery.
DM nucleus	-	Nucleus
3MS	-	Moderate mini mental state examination
CASI	-	Cognitive abilities screening instrument.
AMTS	-	Abbreviated mental test score
IQCODE	-	Informant questionnaire on cognitive Decline in the elderly
VaD	-	Vascular dementia
HVMMSE	-	Hindi version of MMSE
HMSE	-	Hindi mental state examination

FTLD	-	Fronto-temporal lobar degeneration
AD	-	Alzheimer's disease
SD	-	Sementic dementia
QD	-	Questionable dementia
PPV	-	Positive predictive value
PSP	-	Progressive supranuclear palsy
CVD	-	Cortico basal degeneration
MSA	-	Multiple system atrophy
DRS	-	Dementia rating scale
MoCA-BJ	-	Montreal cognitive assessment- Beijing version
RUDAS	-	Rowland universal dementia assessment scale
CERAD-NP	-	Consortium to establish a registry for alzheimer's disease- Neuro psychological battery
VaMTP	-	Visual assessment- medical temporal lobe atrophy
HADS	-	Hospital anxiety depression scale
T-ACE	-	Tamil ACE
SICU	-	Surgical intensive care unit
ICCU	-	Intensive coronary care unit
CT-ICU	-	Cardio thoracic intensive care unit
MICU	-	Medical intensive care unit
CDR	-	Clinical dementia rating scale
RAVLT	-	Rey auditory verbal learning test
WMS	-	Wechiler memory scale revised

ABSTRACT

ABSTRACT

BACKGROUND AND OBJECTIVES:

To develop a Dementia screening instrument for Tamil speaking patients, to adapt translate and develop normative value of ACE (Addenbroke's cognitive examination) for Tamil speaking patients.

METHODS:

Ethical committee clearance was obtained. Consent was taken from 100 Patients in the age group of 57-77yrs who were diagnosed not to have dementia by the neurologists.

They were then divided into groups based on age, gender, ACE scoring, language, education, orientation, attention, concentration, memory, ante grade memory, retrograde memory, verbal fluency, comprehension, repetition, reading writing visuo-spatial abilities, recall, recognition and perception abilities.

These were the variables studied along with their association with dementia.

The data was analysed with the SPSS version 20.0

RESULTS:

- With an increase in age the ACE score and increased
- Higher the education, higher the ACE score.
- ACE score significantly differed between different age group of our study.
- 65 patients were diagnosed with Dementia out of the 100 patients examined, using the Tamil ACE scale.

CONCLUSION:

- Tamil version of ACE is compatible with the original ACE as far as performance, among the normal elders.
- ACE-score correlates well with education of nor elders.
- T-ACE appear to be good tool to diagnose Dementia in Tamil speaking patients.

KEY WORDS: T-ACE (Tamil Addenbrookes Cognitive Examination)

INTRODUCTION

INTRODUCTION

Definition acquired deterioration in cognitive abilities that impairs the successful performance of activities of daily living. Episodic memory, the ability to recall events specific time and place, is the cognitive function most commonly lost.

India, a country which is considered to be one of the countries with the largest population of old people, needs to have an organized and efficient way of addressing the mental health of aged people.[1] The overall population of elderly in India is expected to reach over 150 million in the next few years.[2] Owing to this spike in the population it is expected that conditions like dementia would be reported more often than now. There have been many studies that emphasizes on the increasing number of cases of dementia.[3] The occurrence of dementia in India in the recent years was estimated to be around 1.4% in people above the age of 65.[4] In people above the age of 60, it was estimated to be above 3.5% where they came from a rural background.[5] The rate of affliction for people above the age of 65 years from urban settings was estimated to be above 2.44%.[6] The increasing rates of dementia reported in India currently indicates 10.6% in people above the age of 65 in rural areas while it was 7.5% for people in urban areas.[7]

Dementia is an umbrella term for a group of diseases causing a progressive and irreversible cognitive decline in elderly people including Alzheimer's disease, Fronto-temporal dementia and others. The affected person gradually loses the ability to manage their own life and experiences difficulties in everyday activities including personal care. In 2005 the estimation of people having dementia worldwide was 24.3 million and an annual increase of 4.6million new cases was anticipated (Hummelová-Fanfrdlová et al., 2006).As already mentioned, there is an increasing number of older patients with suspected dementia. Consequently, there is a high demand for the development of a screening method which would be brief, sensitive to early cognitive

deficits and also easy to administer (Konstantinopoulou et al., 2011).The most commonly used screening method for cognitive impairment detection is certainly the Mini Mental State Examination (MMSE). Its great advantage is the brevity, easy administration and wide accessibility for clinicians, GPs or care workers since no special training is required for its use (Raisová et al., 2011)Even if MMSE is used worldwide and accepted as a valid tool for dementia detection, there is still more evidence showing that the test has several limitations and insufficiencies (Hoops et al., 2009).The Montreal Cognitive Assessment (MOCA) is another cognitive screening test which might be used in dementia diagnosis. It is a brief 30-point assessment examining various cognitive abilities. The task assessing the short-term memory contains learning of five words and their delayed recall. Clock drawing task and drawing of 3-dimensional cube are used to examine individual's visuo-spatial abilities. Picture naming task, repetition of sentences and verbal fluency task are used to assess the language abilities of the individual. Several items are assessing also attention, concentration, orientation or working memory (Nasreddine et al., 2005). ACE is a brief bedside neuropsychological screening battery that provides a detection of mild dementia and is also efficient in differential diagnosis since it is able to distinguish between Alzheimer's disease and Fronto-temporal dementia (Larner, 2007). It incorporates all the MMSE which is expanded on the items assessing the cognitive domains such as memory, visuo-spatial abilities or language and also includes the subtest evaluating the verbal fluency (Yoshida et al., 2009). This dementia screening tool has been adopted in many countries and translated into various languages because its sensitivity, specificity and accuracy for dementia diagnosis have been confirmed by several validation studies (Konstantinopoulou et al., 2011).The ACE-R is, however, a relatively new testing method and not as widely studied and used as its original version ACE. Even though the countries which currently use their own version of ACE-R

report its benefits, there is still need to test this tool across the world and adapt it cross-culturally (Carvalho et al., 2012).

It is critical that cognitive impairment and dementia is detected early. Managing the condition may require different strategies based on the severity and occurrence of the condition.[8] Clinics called as specialized memory clinics help in identifying and treating the condition more comprehensively. Assessments could help in providing differential diagnoses of subtypes of dementia. Alzheimer's disease and vascular dementia are identified as two of the major kinds of dementia in some geographical areas.[9]

Among developing countries, as elsewhere, Alzheimer's disease and vascular dementia are the two most common types of dementia observed.[9] The diagnosis of MCI could be difficult in specific ethnic communities as there would be no sufficient normative data in a country as vast as India. There are research communities that have carried out assessments like neuropsychological tests irrespective of a cultural context. Alzheimer's has been diagnosed based on this DSM-IV criteria.[10] A lot of standard procedures are also available that characterizes Alzheimer's disease and vascular dementia.[11, 12]

Cognitive impairment could be diagnosed in certain ethnic communities using neuropsychological evaluations.[13] This proves to be advantageous for implementing the evaluation methods for dementia in countries like India. It also evaluates the effectiveness of dementia tests in hospitals for analysing cognitive impairment. The prevalence of memory clinics in India is very less. India has a very vast and diverse cultural setting and the services provided by the clinics has to accommodate the challenges of language and cultural diversity. The current research uses elderly subjects for evaluating dementia using normal procedures. The difficulties in analysing cognitive disorders have also been studied extensively.

AIMS & OBJECTIVES

AIMS AND OBJECTIVES

1. To adapt translate and develop normative value of ACE (Addenbrook's cognitive examination) for Tamil speaking patients.
2. To know the prevalence of dementia in patients, coming to Sree Mookambika Institute of medical sciences, Kulasekharam

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Definition of Dementia

Dementia is a clinical syndrome characterized by "a global deterioration of mental functioning in its cognitive, emotional and conative aspects" [14]

Historical background

In the 1940s, Mayer-Gross, Guttman[15] and others identified the fundamental defects that constitute the syndrome of dementia. Memory impairment that is evident in learning, retention and recall of both new information and the distant past was considered essential to the diagnosis. However, dementia is more than just forgetfulness [16].

The various neurological features (are often more directly determined by the location and severity of the brain damage.[17,18] At least one of the following symptoms primary symptoms or the primary symptoms is usually required as well:

- Impairment of thinking,
- Reasoning,
- Communication,
- Orientation,
- Practical abilities, ie,
    - Greater difficulty maintaining learned skills or
    - Managing everyday activities, and
    - Personality changes resulting in
        - Lack of insight and judgment,

- Disinhibition,
- Aggressiveness,
- Emotional bluntness and

- Lack of empathy [14,19].

Other psychiatric features referred to as the secondary or accessory symptoms such as

- Anxiety,
- Depression,
- Suspiciousness,
- Delusions,
- Obstinacy and
- Anancastic-like behavior, seem to be more related to the patient's awareness of, and reactions and responses to, cerebral dysfunction and its consequences.

These secondary or accessory symptoms are also influenced by the patient's premorbid personality and previous experience, as well as related to better preserved brain functions.[20]

Recently introduced terms such as treatable dementia.[21,22] reversible dementia [21-23] and mild cognitive impairment (MCI)[25,26] highlight the clinical and etiological variability of such conditions.

Pseudodementia coined by Carl Wernicke earlier termed as demence melancholique refers to a dementia-like clinical state in where symptoms of cognitive, emotional and cognitive dysfunction were regarded as secondary to a non-

organic mental disorder. Pseudodementia means a chronic hysterical states, mimicking mental weakness.[27]

The primary criterion for diagnosis of dementia is evidence of a decline in both memory and thinking, leading to significant impairment of functioning compared with previous levels.[28]

Dementia is a clinical syndrome caused by neurodegeneration (Alzheimer's disease, vascular dementia, Lewy body, and frontotemporal dementia being the most common underlying pathologies) and characterized by inexorably progressive deterioration in cognitive ability and capacity for independent living.

Types of Dementia

"Benign senescent forgetfulness"[29,30], "age associated mental impairment" (AAMI) [31-33] and "mild cognitive impairment" (MCI) have been adopted to indicate alternative interpretations of cognitive decline with increasing age.

"Ischemic Vascular Dementia" (IVD) in 1992, describing probable, possible, and definite IVD, as well as "mixed dementia" [34]. VaD was also defined in terms of brain imaging, thereby extending the concept to include MID, "single stroke dementia" and Binswanger's disease.

A third major category, sometimes called "other secondary dementias". This category contains miscellaneous types of dementia, including the majority of presently treatable conditions, such as those caused by hydrocephalus [35-37], endocrine, metabolic and nutritional disorders[38,39] infections and exposure to toxic factors. There are substantial geographic, ethnic and socioeconomic variations with regard to the presence of some of these etiological variables. The further

development of neuroimaging, biochemical markers, genetic markers and treatment strategies will gradually add to our knowledge in this field. Neuropathology remains the gold standard for definitive diagnosis of dementia. A decline in post mortem examinations will severely limit our knowledge of normal aging and the true prevalence of different types of dementia.

Alzheimer's disease: During the course of Alzheimer's disease, excessive and abnormally folded proteins accumulating in the brain result in the formation of protein 'plaques' around neurones and 'tangles' inside neurones, leading to the death of these brain cells, particularly in the region responsible for memory. The levels of neurotransmitters (chemical 'messengers') are also affected, disrupting communication within the brain. A combination of factors including age, genetic inheritance, environmental factors, diet and overall general health contribute to the onset and progression of the disease. Vascular dementia stroke or a series of small strokes may cause damage to the network of blood vessels (the vascular system) that transport blood within the brain. The resulting disruptions in the supply of oxygen (which is transported in the blood) can lead to the death of brain cells, resulting in the symptoms of this type of dementia. Risk factors for vascular dementia include high blood pressure, heart problems, high cholesterol and diabetes. The type of permanent brain damage caused by the interruption in the supply of blood to the brain during a stroke depends on which area of the brain has been damaged. 'Single-infarct' vascular dementia is caused by a single stroke that results in death of the brain cells in one, relatively large, area. 'Multi-infarct' vascular dementia is caused by a series of small strokes over time which cause death to brain cells in many relatively small areas, but which may not necessarily be noticed at the time by the

individual experiencing them. Vascular dementia may also be a result of 'small vessel disease' (also known as 'sub-cortical vascular dementia', or Binswanger's disease), in which blood vessels lying deep in the brain become damaged.

Dementia with Lewy bodies (DLB) and Parkinson's disease dementia (PDD) Lewy bodies are spherical protein deposits that build up in brain cells, interfere with the chemical 'messengers' in the brain, and disrupt the brain's normal functioning. The precise mechanisms by which the Lewy bodies cause damage in the brain are not yet well understood. Lewy bodies are also found in the brains of people with Parkinson's disease, and a significant number of people with Parkinson's disease will also go on to develop dementia.16 The relationship between DLB and PDD is complex: it is thought that while the two conditions are part of the same continuum, they produce different signs and symptoms as a result of the different distribution of Lewy bodies in the brain [45].

ETIOLOGY

Age

Although young-onset cases are increasingly recognized, dementia is typically a condition that affects older people (44) Dementia incidence increases exponentially with age between the ages of 65 and 90 years and doubles approximately every 5 years. (32)

Approximately 5 to 8 % have dementia at age 65 to 70 years ,15 to 20 % have dementia at age 75 to 80 years, up to 40 to 50 % have dementia over age 85

Type of dementia

Alzheimer's disease is most common dementia accounts for 50-75%, Dementia with Lewy bodies accounts for 15 to 35 %, Vascular dementia accounts for 5 – 20 %

Gender

There is a lower risk of dementia among women with higher levels of education, but not among men. A meta-analysis of European studies found a similar result in participants younger than 90 years.[41,42]

PATHOLOGY

The prevalence of dementia is expected to increase three fold in the next 40 years[13]. Dementia can be caused by a wide range of pathological entities. Every dementia subtype has a specific pathogenesis and risk factors that must be understood in order to develop prevention and treatment strategies

Based on the etiology

- Neurodegenerative Alzheimer's Ds; Dementia with Lewy Bodies; Frontotemporal Dementia; Parkinson’s Ds
- Vascular Infarction; Hemodynamic Insufficiency

Table 1: Causes of Dementia[30]

A.MULTIFOCAL/DIFFUSE DISEASE:
1. Large vessel dementia (LVD):
Multiple infarct dementia (MID): multiple large artery /borderline infarcts ,cortical & subcortical, with perifocal lesions in gray & white matter
2. Small vessel dementia(SVD):
• **Subcortical infarct dementia:**
• **Multiple small lacunar infarct with perifocal lesions in white matter.**
• **" Granular atrophy " of cortex (multifocal cortical micro infarct)**
• **Lacunes & multilacunar state**
• **Binswanger subcortical (leuco)encephalopathy**
• **Hereditary angiopathies- CADASIL(Cerebral Autosomal**
• **Dominant Arteriopathy with Subcortical Infarcts & Leucoencephalopathy) & others.**
• **Cortical plus subcortical dementia:**
• **Multiple, restricted small infarcts due to:**
• **Hypertensive arteriolo sclerotic angiopathy**
• **Cerebral amyloid angiopathy, with or without hemorrhages**
• **Collagen or inflammatory vascular disease(angitis, PCNSA, FMD)**
• **Hereditary forms of CAA**
3. Hypoperfusive ,hypoxic-ischemic dementia(HHD):
• **Incomplete white matter infarcts**
• **Anti-PL related ischemia**
• **Diffuse ischemic hypoxic ischemic encephalopathy(cortical lacunar necrosis, post cardiac arrest , hypotension)**
4.Venous infarct dementia:
• **Large hemorrhagic, congestive symmetric infarcts due to thrombosis of the sagittal sinus or great vein of galen.**

5.Hemorrhagic dementia:
• **Subdural haemorrhage**
• **Subarachnoid haemorrhage**
• **Intracerebral hemorrhage**
• **Multiple microbleeds , particularly subcortical.**
B.FOCAL DISEASE/STRATEGIC INFARCT DEMENTIA(SID):
• **Small infarcts restricted to functional important region**
• **Mesial temporal (including hippocampal) infarcts/ ischemia/sclerosis**
• **Caudate & thalamic infarcts(especially DM nucleus, bilateral lesions)**
• **Fronto-cingulate infarcts (basal forebrain,ACA).**
• **Angular gyrus infarct (dominant cerebral hemisphere- ACA and MCA territories)**
• **White matter key areas**
• **Anti-PL, anti-phospholipid; PCNSA, primary angitis/arteritis of the central nervous system; FMD,fibromuscular dysplasia; ACA,anterior cerebral artery ; DM,dorsomedial;CAA,cerebral amyloid angiopathy.**

- Neurological Multiple Sclerosis; Normal Pressure Hydrocephalus
- Endocrine Hypothyroidism
- Nutritional Def. Of Vit. B12, Thiamine, Niacin
- Infectious Hiv; Prion Ds; Neurosyphilis; Cryptococcus
- Metabolic Hepatic/ Renal Insufficiency; Wilson's Ds
- Traumatic Subdural Haematoma; Dementia Pugilistica
- Toxic Agents Alcohol; Heavy Metals; Anticholinergic Med; Co

Based on the reversibility

- Reversible Dementia [43]
- Delirium
- Emotions (depression)& Endocrine Disease
- Metabolic Disturbances
- Eye & Ear Impairments
- Nutritional Disorders
- Tumors, Toxicity, Trauma to Head
- Infectious Disorders
- Alcohol, Arteriosclerosis
- Ireversible Dementia[45]
- Alzheimer's Lewy Body Dementia
- Pick's Disease (Frontotemperal Dementia)
- Parkinson's
- Vascular
- Huntington's Disease
- Jacob-Cruzefeldt Disease

Based on the location

1. Cortical Dementia
2. Subcortical Dementia
3. Mixed

SIGNS AND SYMPTOMS

Depending on the stage at which it is diagnosed, the indications of dementia may be distinct to a large extent [37]. The commonly afflicted areas are the cognitive and visual special capabilities. The progression of the disease is slow and continuous.

The different symptoms progress with time, but at a variable rate, and according to the regions of the brain affected by the underlying disease. Other forms of dementia tend not to be characterised into formalised 'stages' in quite the same way. A very low percentage (upto 10 percent) of the patients afflicted with dementia have a condition termed as mixed dementia. The condition is associated with Alzheimer's disease and the frontotemporal or vascular dementia. The symptoms could be evident as: [40]

- Tremor and loss of balance.
- Difficulties in speech
- Issues in swallowing
- Distorted memory
- Meandering behaviour
- Issues in vision [41]

In addition to these symptoms certain other behavioral issues accompany dementia which may be shown as [42][43]]

- Agitation
- Depression
- Tension and restlessness
- Uncontrolled motor behaviour

- Elation
- Irritation
- Uncaring attitude
- Impulsiveness
- Unreasonable thoughts bordering delusions
- Altered sleep and appetite patterns

It has often been noticed that when the patients face situations that they are not able to manage, they may have an immediate reaction of despair or displeasure. Previous analysis also mentions that dementia is often accompanied psychosis and animosity.[46]

Cognitive testing

The normal testing procedures for dementia are short and brief that may range between 5 and 15 minutes

- MMSE
- 3MS
- AMTS
- abbreviated mental test score (AMTS),
- the, Modified Mini-Mental State Examination (3MS
- the Cognitive Abilities Screening Instrument (CASI
- Trail-making test,[61] and the clock drawing test
- The MOCA (Montreal Cognitive Assessment) is a very reliable screening test and is available online for free in 35 different languages. The MOCA has also been shown somewhat better at detecting mild cognitive impairment than the MMSE.

- Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE)
- General Practitioner Assessment Of Cognition [47]

Table 2 Classification of Dementia[48]

	AD	VaD	LBD	FBD
History	Gradual onset and progression	Abrupt or gradual onset. Step wise or gradual progression.	Insidious onset. Progression with fluctuations.	Early onset,insidious onset. Rapid progression
Physical signs and symptoms	Normal gait, normal neurological exam in the early to mid stages.	Gait abnormalities, signs of vascular disease and focal neurological signs.	Shuffled gait, increased tone, tremors, slow moving.	At the Late stage,patients develop gait abnormalities along with primitive reflexes.
Other signs and symptoms	Memory loss, language deficits, mood swings and personality changes	Memory loss, language deficit, dysarthria, emotional liability, decreased concentration.	Depression, hallucinations,variable in terms of day to day symptoms.	Poor judgement, social withdrawal and socially inappropriate behaviour.
Imaging	Generalized atrophy with noted medial Temporal lobe atrophy.	Strokes, lacunar infarcts, white matter lesion are noted	Generalized atrophy throughout	Frontal and temporal lobes are atrophied
Pathology	Beta amyloid plates and neuro-fibrillary tangles.	Cerebro vascular disease due to common cerebro-vascular risk factors.	Lewy bodies are present in both the cortex and the mid brain areas.	Absence of plaques and tangles. Pick cells and bodies are present in the cortex

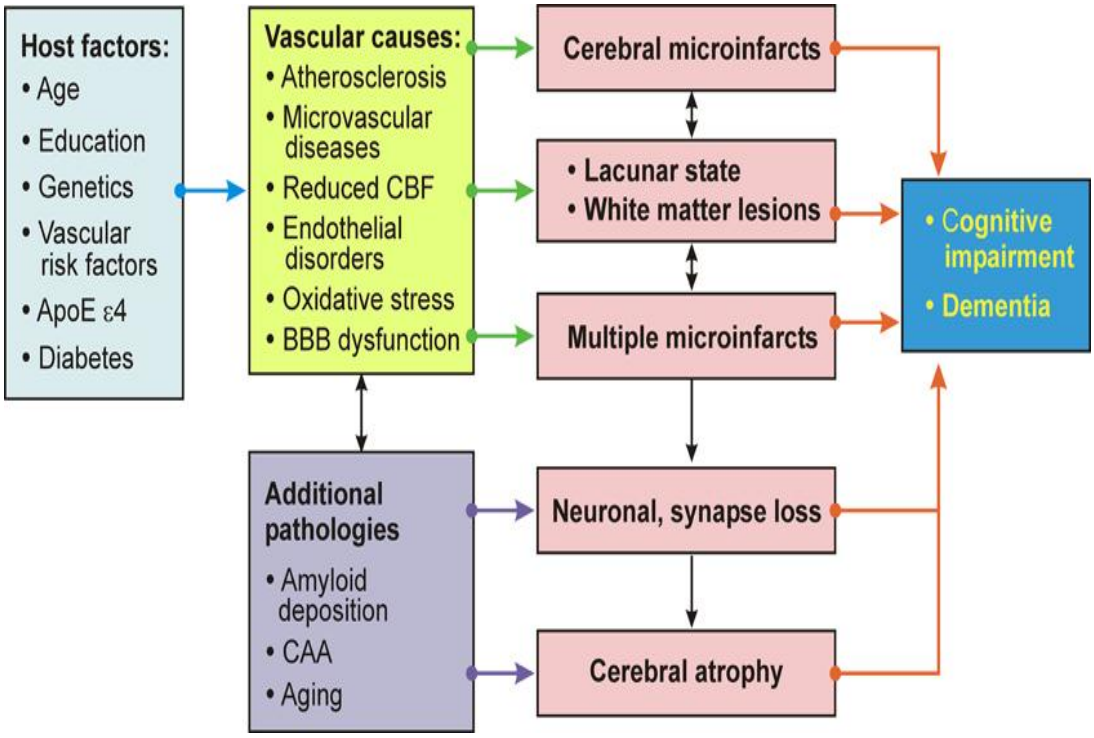

Figure 1. Etiology of Dementia[49]

INVESTIGATIONS ASSESSMENTS

Complete blood count, serum electrolytes, renal and hepatic function, glucose, albumin and protein, vitamin B12 and folate, rapid plasma reagin (syphilis), thyroid- stimulating hormone, urinalysis Rule out correctable or contributory causes of dementia

Imaging: Computed tomography without contrast or magnetic resonance imaging Rule out infarcts, mass lesions, tumors, and hydrocephalus

Neurological examination Correlate imaging findings with clinical examination Neuropsychological testing Mini-Mental State Examination: Screening test of cognitive function[50]

DIFFERENTIAL DIAGNOSIS

- Delirium′
- Mild Cognitive Impairment′
- Age-Related Cognitive′ Decline
- Mental Retardation′
- Schizophrenia′ Depression
- Factitious D/O
- Alcohol Abuse′

DEMENTIA INCIDENCE

Particularly rapid increases in the numbers and proportion of older people are forecast for China, India, and Latin America.

By 2050, the number of people aged ≥60 years will have increased by 1.25 billion, accounting for 22% of the world's population, with 79% living in the world's less developed regions. [52]

TRENDS IN PREVALENCE OVER TIME

The Impact of Dementia

One of the major reasons for impairment in elderly people across the world is dementia. Even though an elderly patient is subjected to physical disability, they can adjust to the limitations fairly well. But this is in stark contradiction to the impairment that happens to the cognitive senses. Dementia can make an individual seriously impaired, unable to handle their basic tasks (5). The condition is associated with the need to have a caregiver for helping the patient get through their daily routines. The caregiver provides their services from the onset of the disease till

their death. The care provided by friends, family, and the community is the most ideal support system that a patient could get.

In all world regions, informal care provided by family, friends and the community is the cornerstone of the care system.

LITERATURE

Mattis S et al[54] (1988) The ACE requires more time than the MMSE to complete but rarely takes in excess of 15 to 20 minutes, except in very demented subjects. It is most useful, however, in patients with early and mild dementia. The loss in brevity is offset by a gain in the sensitivity for early dementia and being able to predict the type of dementia. Although the ACE is superior to the MMSE, a comparison with independent batteries such as the AD Assessment Scale–Cog and the Dementia Rating Scale will be valuable. This results apply to a clinic-based patient population, age 44 to 88 years, with predominantly degenerative dementia. The applicability of the ACE in the community requires investigation. The inter-rater and intra rater reliability of the ACE could not be evaluated in this retrospective analysis, but as the ACE assesses cognitive functions in an objective manner the rater related bias is likely to be low. [

Lobo et al[55] (2000) A total of 2346 cases of mild to severe dementia were identified in the 11 studies. Overall, AD was diagnosed in 53.7% of all dementia cases, with a range across studies of 38.5% to 78%. The lower prevalence of AD in the Italian Longitudinal Study on Aging reflected the high proportion of cases in which a subtype of dementia could not be diagnosed. VaD accounted for 15.8% of all dementia cases. There was no clear study-specific variation of subtype with age.

Fratiglioni L et al[56] (2000) the authors examined the association of incident dementia and subtypes with age, sex, and geographic area in Europe. Incidence data from eight population-based studies carried out in seven European countries were compared and pooled. The pooled data included 835 mild to severe dementia cases and 42,996 person-years of follow-up. In all studies a higher proportion of cases were diagnosed with AD (60 to 70% of all demented cases) than vascular dementia (VaD). The incidence of dementia and AD continued to increase with age up to age 85 years, after which rates increased in women but not men. There was a large variation in VaD incidence across studies. In the pooled analysis, the incidence rates increased with age without any substantial difference between men and women. Surprisingly, higher incidence rates of dementia and AD were found in the very old in northwest countries than in southern countries. This study confirms that AD is the most frequent dementing disorder in all ages, and that there is a higher incidence of dementia, specifically AD, in women than men among the very old. Finally, there may be regional differences in dementia incidence.

Barbeau E et al[57] (2004) The results do suggest its potential relevance while screening an elderly community for MCI. Cumulative learning trials may prove to be a reliable index for initial diagnosis of MCI, but inclusion of additional variables from standardized tests should improve the overall accuracy and may represent the ideal strategy to identify subjects who need to be closely followed up for progression to AD.

Malaz Boustani et al[58] (2005) Dementia is common and undiagnosed in primary care. Screening instruments alone have insufficient specificity to establish a valid diagnosis of dementia when used in a comprehensive screening program; these

results may not be generalized to older adults presenting with cognitive complaints. Multiple health system and patient-level factors present barriers to this formal assessment and thus render the current standard of care for dementia diagnosis impractical in primary care settings.

Chapman DP et al[59] (2006) Dementia represents a diverse category of syndromes characterized by deficits in memory, cognitive function, and behavior. Symptoms associated with dementia appear to be distributed along a continuum, with even subsyndromal presentations affecting the health of older adults and meriting intervention. To promote cognitive functioning and independence among older adults, public health interventions need to facilitate both early detection and treatment of dementia. The availability of adult day care and respite services is important in maintaining the health and quality of life of individuals caring for older adults with dementia. Recent advances in the treatment of dementia may slow the course of cognitive decline, thereby enhancing the quality of life of older individuals as well as decreasing costs associated with institutional care. [19]

Mathurnath et al[60] (2010) Prevalence of dementia and AD is higher than any reported from the subcontinent suggesting that dementia in Kerala, South India is not uncommon. Increasing age increased dementia and AD. Low-education is associated with dementia and female-gender with AD. Five-year follow-up of a community-based, 77+ old cohort including incident dementia cases was used to evaluate the impact of dementia on the risk of death, taking into account other chronic conditions potentially related to death, and contrasting Alzheimer's disease (AD), and vascular dementia (VaD). In this population, 70% of the dementia cases died during the five years after diagnosis, with a mortality rate specific for dementia

of 2.4 per 100 person-years. After controlling for socio demographic variables and comorbidity, 14% of all deaths could be attributed to dementia with a risk of death among demented subjects twice as high as that for non-demented people. Mortality risk ratios were 2.0 (95% confidence interval 1.5–2.7) for AD and 3.3 (95% confidence interval 2.0–5.3) for VaD. This study confirms that dementing disorders are a major risk factor for death. Even in the oldest old (85+), dementia shortens life, especially among women. [20]

Kochan et al[61] (2010) Prevalence of MCI ranged from 4 to 70% depending on the impairment criteria used. Agreement between different criteria was poor to moderate. This lack of consistency had greatest impact on MCI subtype classifications with many being reclassified as "normal" or into a different subtype when stringency of the criteria was increased or decreased. Higher rates of impairment were found in persons of NESB across all cognitive domains.

Werner et al[62], (1999) Literal translation of the phrase 'no ifs, ands, or buts', is meaningless and has poor sensitivity, specificity and positive predictive value.

P. S. Mathuranath et al[63]., (2004) over the past three years, experience in an Indian population from varying socio economic and educational strata showed that simple and literal translation of many items in the ACE provide good comprehensibility. In the India less than 8 group, low-level scores were seen for 22% on visuospatial, and between 4% and 10% on recall, remote memory and attention. visuospatial also showed a low mean score of 0.8. As expected, the absolute mean scores and the proportion at ceiling on all components were higher in India 9 than in the India less than or equal to 8 group. The absolute mean scores

were higher for the UK than for the India more than or equal to 9 on all except remote memory. For both the groups, however, the proportion at ceiling was more than 80% on orientation, attention, language and naming and was less than 25% on recall and verbal fluency, thereby suggesting that on these components the proportion obtaining the perfect score were relatively comparable between the two groups.

Ganguli et al [64]., (1995) developed a Hindi MMSE for a largely illiterate (74%) rural population in Ballabgarh in North India. The Hindi translation of the selected and modified tests was prepared by a group in New Delhi. A Hindi speaking group in Pittsburg then back translated the hindi version into English allowing clarification of remaining ambiguities.

de Silva HA et al. [65], (2002) Due to the high literacy rate in the country, the MMSE was translated and modified slightly without having to make major changes to the original version. 380 randomly selected subjects over 65 years in a semi-urban area were screened with the translated version of the MMSE. The cut-off score for cognitive impairment was taken as 17. Of the 380 subjects screened, 33 scored < or = 17, and were thus considered cases of suspected dementia.

Tiwari SC et al.[66], (2009) A study conducted among 40 subjects(20 illiterate and 20 literate) aged 60 years and above drawn from the urban community. A systematically translated Hindi version of MMSE(HVMMSE) was administered. After one month, the Hindi Mental State Examination(HMSE) was administrated. The two instruments are not in agreement with regard to classifying elderly people as having possible cognitive impairment or not.

Jones RN et al.[67], (2009) Several studies have described comparisons among heterogeneous populations on MMSE scores, and emphasized the need to review specific differences. Some differences in sub items analysis are due to language group differences, such as those described in a report comparing English and Spanish-speaking subjects, in which discrepant items were orientation to season, state, repeat phrase, and follow command.

Mathuranath et al.[68] (2000): It aimed to validate the ACE as a screening tool to detect mild dementia and differentiate between Alzheimer's disease(AD) and Fronto-temporal dementia (FTD). Mathuranath et al. (2000) investigated the internal consistency, criterion validity and construct validity of the ACE. It was concluded that the ACE maintained good sensitivity across different subtypes and severity of dementia as defined by Clinical Dementia Ratings (CDR). The CDR provides an indicator of an individual's stage in the disease process.

Stephanie Crawford,[69] in 2010 conducted a study on the diagnostic accuracy and clinical utility of the Addenbrooke's Cognitive Examination (ACE) and its updated version, the Addenbrooke's Cognitive Examination – Revised (ACE-R), in relation to the diagnosis of dementia. A systematic search of relevant databases was conducted covering the period 2000 to April 2010 and specific journals and reference lists were hand searched. Identified studies that fulfilled the inclusion criteria were reviewed using a tailored, methodological quality rating checklist. The systematic search process identified 9 studies for review (7 relating to the ACE, 2 on the ACE-R). Each study is described individually before strengths and weaknesses across studies were considered. Diagnostic accuracy measures were presented for 6 out of the 9 studies. The studies included in that review convey the ACE and ACE-R

as tools capable of providing information on a range of cognitive domains and differentiating well between those with and those without cognitive impairment.

Alexopoulos, A. Ebert, et al[70], conducted a study on The diagnostic accuracy of the German version of the revised Addenbrooke's Cognitive Examination (ACE-R) in identifying mild cognitive impairment (MCI), mild dementia in Alzheimer's disease (AD) and mild dementia in frontotemporal lobar degeneration (FTLD) in comparison with the conventional Mini Mental State Examination (MMSE) was assessed. The study encompassed 76 cognitively healthy elderly individuals, 75 patients with MCI, 56 with AD and 22 with FTLD. ACE-R and MMSE were validated against an expert diagnosis based on a comprehensive diagnostic procedure. Statistical analysis was performed using the receiver operating characteristic method and regression analyses. The optimal cut-off score for the ACE-R for detecting MCI, AD, and FTLD was 86/87, 82/83 and 83/84, respectively. ACE-R was superior to MMSE only in the detection of patients with FTLD [area under the curve (AUC): 0.97 vs. 0.92], whilst the accuracy of the two instruments did not differ in identifying MCI and AD. The ratio of the scores of the memory ACE-R subtest to verbal fluency subtest contributed significantly to the discrimination between AD and FTLD (optimal cut-off score: 2.30/2.31, AUC: 0.77), whereas the MMSE and ACE-R total scores did not. The German ACE-R was superior to the most commonly employed MMSE in detecting mild dementia in FTLD and in the differential diagnosis between AD and FTLD. Thus it might serve as a valuable instrument as part of a comprehensive diagnostic workup in specialist centreS/clinics contributing to the diagnosis and differential diagnosis of the cause of dementia.

Henry Brodaty and Cressida M. Moore[71], in 1997 conducted a study to examine the reliability and validity of the Clock Drawing Test when used as a cognitive screening instrument for mild to moderate dementia, and to compare different scoring mechanisms. Retrospective analysis of clock drawing performance using three published scoring methods (Shulman, Sunderland and Wolf-Klein) was used. A sample of 28 consecutive patients attending the memory clinic for assessment who were given a diagnosis of Alzheimer's disease (mild or moderate) and 28 age- and sex-matched control subjects comprising 17 memory clinic attenders found to be normal and 11 community volunteers were analysed. Sensitivity and specificity of the three clock rating scales against memory clinic diagnoses of dementia using DSM-III-R; their respective interrater reliabilities; and comparisons of each with measures of cognitive impairment, daily performance of basic and instrumental activities and depression were performed. All methods of scoring the Clock Drawing Test correlated well with measures of cognitive impairment (r . 0:57±0:73) and daily performance (r . 0:38±0:48), were independent of mild depression and demonstrated high sensitivity, specificity and interrater reliability. While all clock scales identified mild to moderate dementia reasonably well, the Shulman method performed best. In screening for dementia, clock drawing proved superior to the MMSE: 24/28 vs 20/28 cases identified. When compared with the MMSE, clock drawing provided additional diagnostic discrimination, identifying 7/8 AD patients with MMSE scores 524. In a clinic population, clock drawing, especially if scored according to the Shulman scale and combined with the MMSE, is an extremely efficient test screening measure for mild to moderate dementia of the Alzheimer's type with low false negative and false positive rates. This may have implications for screening elderly populations.

Dagmar Fiedorova1, Petra Krulova, et al[72], in 2018, conducted a study on the use of Addenbrooke's Cognitive Examination to compare cognitive function in nondemented and nondepressed stroke patients, 3 months after the stroke, with sex- and age-matched controls. A total of 156 participants were included (72 controls: 19 men, mean age 64.5 ± 12.4 years; 84 patients after stroke: 54 men, mean age 62.2 ± 9.0 years). Statistically significant differences were identified between controls and stroke patients in total Addenbrooke's score (stroke patients, 86.2 points vs controls, 91.2 points; $p<0.01$), Verbal Production domain (stroke patients, 9.8 points vs controls, 11.5 points; $p<0.01$), and Memory domain (stroke patients, 19.5 points vs controls, 21.7 points; $p<0.01$). The difference was also statistically significant between subgroups of stroke patients and controls: patients with a right-sided brain lesion differed from controls in total scores (88.3 vs 91.3 points, respectively; $p<0.05$) and Verbal Production domain scores (9.9 vs 11.5 points, $p<0.01$), as did patients with left-sided brain lesions in total score (83.9 vs 91.3 points; $p<0.01$) and Memory (18.6 vs 21.7 points; $p<0.01$) and Verbal Production (9.6 vs 11.5 points; $p<0.01$) domains.The study showed the usability of Addenbrooke's Cognitive Examination 3 months after a stroke to detect mild cognitive decline, providing a basis for initiating cognitive rehabilitation as soon as possible.

Hidenori Yoshida, Seishi Terada, et al.[73], in 2009, conducted a study on the diagnostic accuracy of the Japanese version of Addenbrooke's Cognitive Examination (ACE) in identifying early dementia in comparison with the conventional Mini-Mental State Examination (MMSE). Standard tests for evaluating dementia screening tests were applied. A total of 201 subjects (65 Alzheimer's disease,24 frontotemporal dementia, 26 vascular dementia, 11 dementia with Lewy

bodies, 13 mild cognitive impairment , and 62controls) participated in the study. The reliability of the ACE was very good (alpha coefficient=0.82). In the patient series, the sensitivity for diagnosing dementia with an ACE score of ≤74 was 0.889 with a specificity of 0.987, and the sensitivity of an ACE score of ≤80 was 0.984 with a specificity of 0.867. The study found out that the Japanese version of the ACE is a very accurate instrument for the detection of early dementia, and should be widely used in clinical practice.

Greim, K. Nadler, et al.[74], in 2006, conducted a study on the diagnostic accuracy of the German version of the Addenbrooke's Cognitive Examination (ACE) in identifying early Alzheimer's disease (AD) and mild vascular dementia (VaD) in comparison with the conventional Mini Mental State Examination (MMSE). The study involved 50 patients with mild dementia of AD, 26 patients with mild dementia of vascular etiology and 54 cognitively normal subjects. The ACE and MMSE were validated against an expert diagnosis based on a comprehensive diagnostic workup. Statistical analysis was performed using the receiver operator characteristics method. The optimal cut-off score for the ACE for detecting dementia in patients with early AD was 85/86, which had a sensitivity of 93% and a specificity of 86%. The optimal cut-off for the ACE for the identification of dementia in patients with mild VaD was also 85/86 and it had a sensitivity of 93% and a specificity of 100%. The values imply a substantial agreement between the diagnoses made by the ACE and the MMSE. The German version of the ACE is a short and practical but accurate test battery for the identification of AD and VaD, assessing a broad range of cognitive functions and providing a wide profile of cognitive functions/dysfunctions.

Davies et al.[75] made a study aimed to assess the ACE's ability to differentiate between Alzheimer's disease (AD) and Semantic dementia (SD, a subtype of Fronto-temporal dementia). ACE items were grouped into 12 sub scores and performances on these sub scores were compared between the SD and AD groups. SD participants performed significantly poorer on naming and reading items, whereas AD participants were significantly poorer on orientation items.

Galton et al. (2005)[76]: The aim of this study was to address the relative value of the ACE in comparison with more detailed, neuropsychological tests and evaluation of the medial temporal lobe (via magnetic resonance imaging, MRI) in predicting participant conversion from questionable dementia (QD, a concept similar to MCI) to Alzheimer's disease (AD). The ACE had the best combination of Positive Predictive Value (PPV) and sensitivity compared to other neuropsychological tests, for predicting participant conversion from QD to AD. An ACE cut off of 80 provided best separation between converters and non converters and was the single best predictor of progression to AD

Reyes et al. (2009)[77] This study investigated the validity of the ACE as a means of assessing cognitive function in patients with Parkinson's disease (PD). Participants from a PD outpatient clinic were recruited (n=44). The Mattis Dementia Rating Scale (MDRS) was used as the gold standard reference method. The study used a variety of tools to measure the disease progression and the symptoms of Parkinson's. The ACE and the MDRS were found to correlate well ($r = 0.91$, $p<0.0001$), thus it was concluded that the ACE was a valid tool for dementia evaluation in PD.

Larner's (2007a)[78] study reports ACE data from 285 participants and received a full assessment (including 1 year follow-up) and were subsequently classified, independently of their ACE performance, as individuals with either dementia or non-dementia. The 88 and 83 cut offs reportedly had good sensitivity but poorer specificity; an alternative cut off of 75 improved specificity.

Bak et al.[79] (2005): The aim of this study was to examine the cognitive profile of three subcortical dementia disorders associated with parkinsonism (Progressive supranuclear palsy (PSP), Corticobasal degeneration (CBD) and Multiple systems atrophy (MSA) compared with a group of participants with AD and a group of healthy controls. The ACE and the Dementia Rating Scale (DRS) were used to compare the different participant groups. Two of the subcortical dementia groups (PSP and CBD) along with the AD group were significantly impaired on the ACE total score, compared to controls; however, the ACE did not detect cognitive impairment in the other subcortical group (MSA).

Mioshi et al.[80], 2007 This article introduced the ACE-R and aimed to validate the clinical utility of their versions of the ACE. Three groups of participants were included in the study: dementia (AD, FTD, LB), healthy controls and MCI. Participants were excluded if they had a psychiatric disorder, mixed dementia or cognitive impairment caused by something other than a neurodegenerative disease. Two cut off scores were defined (88 and 82) based on sensitivity, specificity and positive predictive value calculations at different prevalence rates. Participant performance on the ACE compared to the ACE-R was investigated; however, it is unclear when the ACE and ACE-R were undertaken in relation to each other. A subgroup of age and education matched participants was elicited from control, AD,

and MCI groups; from these subgroups the MCI group performance was found to be between the AD and control groups. MCI patients to be impaired in areas other than memory (orientation/attention, verbal fluency, language and visuospatial).The ACE-R accomplishes standards of a valid dementia scaling test sensitive to early cognitive dysfunction.

Dhara Abhinav Sharma[81] et al. (2016) This methodological study was done in Ahmedabad institute of medical sciences, Gujarat, India from November 2016 to May 2017.In this correlational study, ACE III was translated to Gujarat people by using forward-backward-forward method. The results showed that there is strong positive correlation between original English version and Gujarati version of ACE III with Pearsons correlation coefficient r =0.87 and p = 0.01 The Gujarati version correlated with education level of Spearmans correlation coefficient r = 0.75, p = 0.05 and the original English version of ACE III also correlated with education level of older adult with Spearmans correlation coefficient r = 0.75, p = 0.05. This concluded that Gujarati version of ACE III is equivalent to original English ACE III and can be used to assess cognition in older adults.

Thammanard Charernboon et al.[82] (2014) This study was about to assess the accuracy of Thai version of the ACE III. 107 participants aged 60 or above were included in the study. The methods used in this study is forward and backward translation. This study shows that the Thai version of ACE (ACE – T) III is a valid and reliable cognitive assessment tool in the detection of MCI and early dementia in the Thai population.

Hsieh S et al[83] (2013) The aim of the study is to validate the newly developed version of Addenbrooke's Cognitive Examination III against standardised

neuropsychological test and its predecessor. (ACE- R) in early dementia. In this study, 61 dementia patients and 25 controls were included in the study. ACE III cognitive domains correlated significantly with standardised neuropsychological test used in the assessment of language, visuospatial function, verbal memory and attention. The ACE III also compared very favourably with its predecessor, the ACE-R with similar levels of specificity and sensitivity. On the conclusion, this study provides objective validation of the ACE-III as a screening tool for cognitive deficit in FTD and AD.

Latha Velayuthan et.al[84]. They aimed to review systematically brief cognitive tests for suspected dementia and report on their validation in different settings, to help clinician choose rapid and appropriate test. By using qualitative psychometric data the study was done. The results were obtained that Mini Mental State Examination and Hopkins Verbal Learning Test had good psychometric properties in primary care. Addenbrooke's cognitive examination and Montreal cognitive assessment are effective to detect dementia with Parkinsons diseases and ACE-R is used for all dementia. Recently developed ACE-III show promise but need validation of test such as six CIT, abbreviated mental test is also needed for dementia screening in acute hospital settings. So the conclusion is practitioner should use tests as appropriate to the setting and individual patient.

Roshaslina Rosli et al[85] they aimed to rationalized the results of available study which were analysis the validity of cognitive tools for the detection of cognitive impairment and to identify the issues surrounding the available cognitive impairment screening tools in Asia. Here they used five electronic data base (CINAHL, MEDLINE, EMBASE, COCHRANE LIBRARY, SCIENCE DIRECT).

By the end of the study 38 articles, evaluating 28 tools in 7 Asian language were included. These tools were assessed in five studies. Highly variable cut off were reported for the MMSE and Montreal cognitive assessment, with 68%of studies reporting educational bias. From this they concluded that few cognition assessment tools have been validated in Asia, with no published validation studies for many Asian nation and languages.

C.Bier et al[86], (2003) they analysed that ACE, a simple instrument to differentiate fronto temporal dementia from Alzheimer's diseases, in their dementia patient clinic population. The ACE was translate into French with adapation maintaining the number of word in the name and address learning and delayed recall test and with cultural adaptation. A diagnostic agreement was reached for 79 cases with 40 dementia, 25 AD, 9 Fronto Temporal Dementia. They estimated that the sensitivity for detecting dementia of an ACE score </=83/100 was 90%with a specificity of 64.1%they concluded that ACE is very accurate for the detection of dementia, but much less effective in discriminating the most common frontal variant of Frontal Temporal Dementia.

S.M.C. Rasquin et al[87] (2014), they conducted the study with the aim was to investigate the prognostic accuracy of different subtypes of mild cognitive impairment: amnestic MCI, multiple domain MCI, and single nonmemory domain MCI for the development of Alzheimer's dementia(AD) and vascular dementia(VAD).As a result is multiple domain MCI had the higher sensitivity for both AD and VAD and amnestic MCI had the highest specificity. The positive predictive value was low for all subtypes whereas negative predictive value was high. On concluding, the subtypes multiple domain MCI has high sensitivity in

identifying people at risk for developing AD or VAD. The predictive accuracy of MCI subtypes was similar for both AD and VAD.

Fang R et al.[88] (2013) It was done to screen for Alzheimer's disease(AD) or mild cognitive impairment (MCI) studies to validate the Chinese version of Addenbrooke's cognitive examination of –revised (ACE-R) are rare. A total of 151 subjects were included in the study and the neuropsychological assessments were employed. The validity of ACE –R to screen for mild AD and amnestic subtype of MCI was assessed by receiver operating characteristic curves. The result is the Chinese ACE-R is a reliable assessment tool for cognitive impairment. It is more sensitive and accurate in screening for MCI rather than for AD compared to the MMSE.

Yu J et al.[89] (2012) the study was conducted to evaluate the effectiveness of the Beijing version of the montreal cognitive assessment (MoCA-BJ) as a screening tool to detect MCI among Chinese older adults. About 1001 Chinese older adults were included in the study. The MoCA-BJ demonstrated a sensitivity of 90.4% and specificity of 31.3% within the cut off score of 26. When the cut off score was reduced to 22, the MoCA-BJ showed optimal sensitivity (68.7%) and specificity (63.9%). The MoCA-BJ is an acceptable tool for MCI screening in both urban and rural communities but due to the linguistic and cultural differences between the Chinese version and original English version and also the lower educational levels of Chinese older adults, the MoCA-BJ is not much better than MMSE in detecting MCI, atleast for this study sample.

Iype T et al.[90] (2006) the aim of the study was to examine the new cognitive screening test, the Rowland universal dementia assessment scale (RUDAS) and then

compare it with MMSE. About 116 subjects were included. Both screening tests were compared with regard to specificity and sensitivity. The correlation of both tests with years of formal education among the controls were assessed. RUDAS had better specificity and similar sensitivity to MMSE, but did have an educational bias. As a conclusion, RUDAS is a useful brief screening test.

Heo JH et al.[91] (2012). This study was done to assess the diagnostic accuracy of the Korean version of the ACE (K-ACE) in about 115 subjects. The ACE was translated and modified to create the K-ACE. The area under the curve, reliability, verbal language/ orientation memory ratio, sensitivity and specificity were evaluated. The receiver operating characteristic (ROC) curve was used to determine the optimal cut-off score in dementia screening. In diagnosing AD and MCI, ROC curves showed that K-ACE is superior to Korean mini mental status examination. For identifying AD, the optimal cutoff of K-ACE was 68/69, which had a sensitivity of 90% and specificity of 84%.In the Korean elderly,the K-ACE is a short, reliable and valid neuropsychological test that is used to screen for dementia.

Qiao J et al.[92] (2015) In this study, cognitive impairments have been reported to be more common in non-demented patients with Parkinson's disease and literacy plays an important role in intelligence. In this study, they included 69 consecutive Parkinson's patients with over 6 years education level, MMSE score above 24 out of 30 and they performed a battery of neuropsychological scales. By the result, there are extrinsic cognitive domain impairment in PD patients with normal global cognitive according to MMSE. Montreal cognitive assessment is a highly sensitive scale to screen cognitive impairments in PD. So they concluded that the cutoff score

of 28 on the MMSE screening for cognitive impairment in Chinese PD patients with high literacy levels may be more appropriate.

Tunvirachaisakul C et al.[93] (2018) To screen patient's with Alzheimer's dementia, the consortium to establish a registry for alzheimer's disease developed a neuropsychological battery (CERAD- NP).Their aim was to delineate the CERAD-NP features of MCI and their clinical utility to validate MCI diagnosis externally. About 60 patients with MCI and 63 normal controls were taken for the study. Using a combination of Wordlist call, Wordlist memory and verbal fluency test, MCI patients were discriminated from the controls. The most important CERAD-NP features differentiating MCI from normal controls indicate impairments in episodic and semantic memory and recall.While these features discriminate MCI patients from normal controls significantly, the tests are not predictive of MCI.

McKhann G et al[94] (1984) They aimed to 0develop clinical criteria for the diagnosis of Alzheimer's disease include insidious onset and progressive impairment of memory and other cognitive functions. There are no motor, sensory or coordination deficits early in the disease. For this disease, diagnosis cannot be determined by the laboratory tests. These tests are important primarily in identifying the other possible causes for the dementia that must be excluded before the diagnosis of Alzheimer's disease. By the conclusion, the criteria proposed are intended to serve as a guide for the diagnosis of Alzheimer's disease.

Persson K et al[95] (2017) This study was done to whether visual assessment of medial temporal lobe atrophy (vaMTA) can predict 2 year conversion from mild cognitive impairment(MCI) to dementia and progression of MCI and Alzheimer's disease dementia as measured by clinical dementia rating scale. 94 patients with

MCI and 124 patients with AD were studied. vaMTA was associated with MCI conversion in an unadjusted model but not in an adjusted model (p= 0-075). In adjusted models, memory function, APOA ∑4 status and age were significant prediction of the disease progression, not vaMTA .The association between vaMTA and CDR –SB change was different in patient with MCI and AD dementia.

Chandler MJ et al[96] (2005).The study was to develop a total or composite score for the consortium to establish the registry for Alzhemier's diseases(CERAD) neuropsycological battery. CERAD total scores were obtained by summing scores from the individual CERAD sub test in to a total composite. The results were obtained that the CERAD total score was highly accurate in differentiating NC and AD subjects in the CERAD registry. Age, gender and education effects were observed and demographic correction were derived through multiple regression analysis.Based on the results they concluded that the study provide support for the validity of the CERAD total score that can be used along with the normative data to provide an index of overall level of cognitive functioning from the CERAD neuropsychological battery.

Karrasch M et al[97] (2005) The aim of the study was to examine the consortium to establish a registry for Alzheimer's disease (CERAD) test performances in patients suffering from amnestic mild cognitive impairment(MCI) and mild Alzheimer's disease(AD).15 healthy elderly individuals, 15 amnestic MCI patients and 15 probable AD patients suffering from mild dementia were studied. The MCI group was differentiated from the controls only in the wordlist learning test. In the language test, the sensitivity to MCI and AD was quite low and the specificity was very high. In the savings scores the sensitivity to AD was high, but

the specificity rather low.Cutoff scores for the wordlist learning test and wordlist delayed recall that have been found to differentiate normal aging from dementia, are lacking in the finnish CERAD.The results indicate that the finnish CERAD test battery with its current cutoff scores has low sensitivity to MCI. The results indicate that the finnish CERAD test battery with its current cut off scores has low sensitivity to MCI and using it as a sole cognitive screening instrument for MCI and preclinical dementia might result in false negatives.

Petersen RC et al.[98] (1999) This study was to characterize clinically subjects with MCI cross sectionally and longitudinally. 76 consecutively evaluated subjects with MCI were compared with 234 healthy control and 106 patients with mild Alzheimer's disease(AD), all from a community clinic setting. The results were obtained that the primary distinction between control subjects and subjects with MCI was in the areaof memory, while other cognitive functions were comparable. However, when the subjects with MCI were compared with the patients very mild AD, memory performance was similar, but patients with AD were more impaired in other other cognitive domains as well. Longitudinal performance showed that the subjects with MCI declined at a rate greater than that of the control. So they concluded that the patients who meet the criteria for MCI can be differentiated from healthy control subjects and those with mild AD.

Broche-Perez Y et al.[99] (2018) the aim of the study is to assess the diagnostic accuracy of the Cuban version of the revised Addenbrooke's cognitive examination in identifying mild cognitive impairment in comparison with the mini-mental state examination. 129 elderly subjects were included in this study where Cuban ACE-R was administered. Cronbach's coefficient α was used to evaluate the reliability of

psychometric scales. The Cuban ACE-R had reliable internal consistency. From the result, the Cuban ACE-R is a valid screening tool for detecting cognitive impairment. It is more sensitive and accurate in screening for MCI than MMSE.

Larner AJ et al.[100](2014) The ACE and its ACE-R are relatively new screening tools for cognitive impairment that may improve upon the well-known MMSE and other brief batteries. A meta analysis of suitable studies was conducted. From the result, they concluded that the ACE-R has somewhat superior diagnostic accuracy to the MMSE while the ACE appears to have inferior accuracy. The ACE-R is recommended in both modest and high prevalence settings. Accuracy of newer versions of the ACE remain to be determined.

Munoz-Nehra C et al. [101](2012) this study is to assess the cognitive capacities in dementia by Addenbrooke's cognitive examination – revised as an alternative to MMSE. They also aimed to estimate the psychometric properties and diagnostic utility of the Addenbrooke's cognitive examination- revised in a Chilean elderly population. Results were obtained that regarding convergent validity, the ACE-R-Ch showed significant correlation with another cognitive measure i.e MMSE. From the results they concluded that the ACE-R Ch showed acceptable psychometric properties, becoming a valid and reliable instrument to assess global cognitive efficiency or cognitive impairment. Its diagnostic utility to detect dementia patients also worked very well in a Chilean elderly sample.

So M, Foxe D, Kumfor F et al [102] examined the relationship between the most recent version (ACE-III) and its predecessor (ACE-R), determined ACE-III cutoff scores for the detection of dementia, and explored its relationship with functional ability. Study 1: ACE-III and ACE-R scores differed by ≤1 point overall,

the magnitude varying according to dementia type. Study 2: a new lower bound cutoff ACE-III score of 84/100 to detect dementia was identified (compared with 82 for the ACE-R). The upper bound cutoff score of 88/100 was retained. Study 3: ACE-III scores were significantly related to functional ability on the Clinical Dementia Rating Scale across all dementia syndromes, except for semantic dementia. The results demonstrate that the ACE-III is an acceptable alternative to the ACE-R. In addition, ACE-III performance has broader clinical implications in that it relates to career reports of functional impairment in most common dementias.

Peixoto B, et al.[103], 2018 This study was to determine the psychometric properties of the Portuguese version of ACE-III, namely: reliability and discriminative validity (sensitivity and specificity) in the identification of mild cognitive impairment (MCI) and dementia the reliability of ACE-III was very good ($\alpha = 0.914$). ACE-III significantly differentiated the 3 groups. The receiver operating characteristic (ROC) curves significantly favored ACE-III in comparison to another screening test - MoCA. ACE-III presented higher levels of sensitivity and specificity. Its total score correlated positively with the results on MoCA ($\rho = 0.912$; $p < 0.001$) and negatively with a depression scale ($\rho = -0.505$; $p < 0.001$). Portuguese version of ACE-III has very good reliability and high diagnostic capacity in the context of MCI and dementia. ACE-III also holds concurrent and divergent validity.

Giebel CM, Challis D[104] (2016) et al this exploratory study assessed the sensitivity of Mini-Mental State Examination, Montreal Cognitive Assessment and the Addenbrooke's Cognitive Examination III each scale to everyday functioning and to examine the cutoffs between mild and moderate dementia on the ACE-III.

Thirty-three dyads completed the measures. Findings suggest the ACE-III more efficiently identifies everyday functional impairments. Further research is required to confirm these exploratory analyses of the cutoff between mild and moderate dementia on the ACE-III. Both functional impairment and stage of dementia are needed in the diagnostic process and in the clinical assessment of people with dementia.

Robert B Dudas et al[105] (2005),concluded that the total ACE score for the AD(Alzeimer's disease) ,FTD(Fronto Temporal Dementia), and mixed groups were significantly lower than the NC group likewise on total score the AD and FTD groups scored significantly lower than either of the pure affective disorder groups. Within the dementia group the AD group scored significant lower than the Fronto Temporal group. The profile of performance on the ACE of patients with dementia is different from that of the patients suffering from affective illness. Mild impairment in the total ACE score along either the low score on the memory domain tasks and letter fluency(in contrast to normal category fluency), as strongly indicative of an affective, as opposed to organic, pathology. A total score of <88 in suspected dementia patients with affective symptoms appear strongly predictive of an underlying organic disorder.

Anabel Chade et al [106](2008) Study was aimed to investigate whether the Spanish version of the Addenbrooke's Cognitive Examination (ACE) is capable of detecting cognitive difficulties in patients with Parkinson's disease and discriminating their cognitive profile from patients with dementia.77 early dementia patients (53 with Alzheimer's Disease and 24 with Frontotemporal Dementia), 22 patients with Parkinson's disease, and 53 healthy controls were evaluated with the

ACE. Parkinson's disease patients significantly differed from both healthy controls and dementia patients on ACE total score. The study shows that the Spanish version of the ACE is capable of detecting patients with cognitive impairment in Parkinson's disease and is able to differentiate them from patients with dementia based on their general cognitive status.

Viviane Amaral Carvalho et al[107] concluded from the study that the mean age of the studied sample of healthy elderly was 75.4years (ranging from 60-89 years). Small additional modifications were necessary after the evaluation of first 10 subjects in order to improve comprehension of the test. The final Portuguese version of the ACE-R was produced and was found to be well understood by the remaining 11 subjects taking an average of 15minutes to be administered. The Brazilian version of ACE-R proved to be a cognitive instrument for testing both in research and clinical setting. With this regard additional studies have been carried out in our unit in order to investigate the diagnostic properties of ACE-R in our mileu.

Gaber TA et al[108] this study aimed at evaluating the use of ACE-R and to establish its sensitivity compared to MMSE in a cohort of brain injury patients. The study revealed that among the 36 patients recruited 31males with a mean age of 37 years and for a upper cut off value of 27/30 for MMSE and 80/100 for ACE-R, their respective sensitivities were 36% and 72 %respectively. For the lower cut-off value of 24/30 and 82/100 the test sensitivities were 11% and 56%, respectively. Analysis of the CE-R sub-tests indicated that memory and verbal fluency sub tests showed the most dramatic impairment. And hence the MMSE is insensitive as a screening test in a brain injury patients. The results show ACE-R to be sensitive and easily administered test.

Cheung G et al [109](2013) the aim of their study was to investigate the three common cognitive screening tools: the Montreal Cognitive Assessment(MoCA), the Rowland Universal Dementia Assessment scale(RUDAS), and the recently revised Addenbrooke's Cognitive assessment version III(ACE-R III). All the three tool discriminated well overall between the cases of mild dementia and controls . And they concluded that to inform the interpretation of these tests in clinical settings, it would be useful for future research to address more inclusive and potentially age-stratified local norms.

Craig G.J Newman et al[110] (2018)The study was aimed to capture the rate and type errors in the clinical practice of Addenbroke cognitive examination III and then reduction in the error rate using a computerized alternative. In study 1,78% of clinically administered ACE-IIIs were either scored incorrectly or had arithmetical errors. In study 2, error rates seen in ACE-III were reduced by 85-93% using ACE mobile.

Maria Sheila et al[111] (2014) Had studied 70 idiopathic PD patients with a mean (SD) age of 64.1 (9.3) years and the mean disease duration of 7.7 (5.3) years and educational level of 5.9 years matched for education and age to controls. 27 patients fulfilled MDS clinical criteria for PD dementia mean scores on the ACE-R were 54.7(12.8) points for patients with PD dementia, 76 (9.9) for PD patients without dementia and 79.7(1.8) points for healthy controls. The area under the receiver operating curve, taking the MDS diagnostic procedure as a reference, was 0.93{95% Cl, 0.87-0.98: p< 0.001} for ACE-R. The optimal cutoff value for ACE-R </= 72 points {sensitivity 90%: specificity 85%: kappa concordance (k) 0.79}. ACE-R appears to be a valid tool for dementia evaluation including patients with

heterogeneous education level, displaying good correlation with clinical criteria and diagnostic procedures of the MDS.

Nadine Mirza et al[112] proposed a study to develop the guidelines a compilation of all he adaptations, procedures undertaken by adapters of the ACE-III and its predecessors is needed. They deemed 32 papers suitable for analysis. 7 translation steps were identified and they determined which items of the ACE-III are culturally dependent. The review lists all adaptation of the ACE, ACE-r and ACE-III, rates the reporting of their adaptations procedures into steps that can be undertaken by adapters

MATERIALS & METHODS

MATERIALS AND METHODS

Development of Instrument

Malayalam version of ACE is translated in to Tamil and back translated necessary modification are made to suit the cultural based requirement. To develop normative value using Tamil version ACE in elderly subjects above 50yr of age attending Sree Mookambika Institute of Medical Sciences, Kulasekharam.

Study Design: Cross sectional study

Study Settings: Patients coming to Sree Mookambika Institute of Medical Sciences.

Duration of the study: 18 months

Study groups: All patients above 50 years coming to Sree Mookambika medical college speaking Tamil will be taken into consideration in the study.

Sample size of each group: 79

Total sample size of the study: 79

Scientific basis of sample size used in the study:

$$n = \frac{\left[\mathrm{Z1}\sqrt{2p(1-p)} + \mathrm{Z2}\sqrt{p1(1-p1)+p2(1-p2)}\right]^2}{[(\mathrm{p1}-\mathrm{p2})]^2}$$

n = sample size

z1 = z value associated with alpha = 1.64

p= average of p1+p2

p1 = probability of outcome in ACE-T i.e differentiate MCI = 0.9

p2 = probability of outcome in ACE-T = 0.99

z1 = z value associated with beta= 0.84

n = 78.28 = 79 [22]

Sampling technique used: Convenient sampling

Inclusion criteria:

- Patient more than 50 year male and female.

Exclusion criteria:

- Patients not willing
- Critically ill patient.
- Bed ridden and unconscious patient

Methods.

The ACE, which can be viewed as an Appendix on the Neurology Web site (www. neurology.org), consists of six components evaluating separate cognitive domains. A maximum score of 100 is weighted as follows: orientation (10), attention (8), memory (35), verbal fluency (14), language (28), and visuospatial ability (5). The orientation and attention components are as in the MMSE. The memory component evaluates episodic memory (recall of three items from the MMSE plus a "name and address learning and delayed recall" test) and semantic memory. The language component includes naming 12 line drawings, comprehension, repeating words and sentences, reading regular and irregular words, and writing.

Visuospatial testing consists of copying overlapping pentagons (from the MMSE) plus a wire cube, and drawing a clock face. Verbal fluency consists of letter fluency for words beginning with the letter P and category fluency for animals. Raw scores are used for all items except for verbal fluency: a scaled scoring system for the letter and category fluency was derived using a Gaussian distribution of the raw scores from normal controls included in this study (see the Appendix at www.neurology.org). Scores for each of the six domains can be calculated separately and their sum gives the composite score on the ACE. The MMSE score can also be calculated. The ACE can be administered in 15 to 20 minutes.

M-ACE was administered to verify general cognition with special interest in M-ACE registration and recall as specific measures of learning and retention. This battery has a global cognitive scale (mini - mental state examination, MMSE), and tests for memory (immediate and delayed recall of a seven-item address list), verbal fluency (initial letter P and categories of animals), confrontation naming (ten items), and constructional praxis (copying two line-drawings). It also assesses executive functions and constructional ability (clock-drawing), [13] remote memory, and language.

Regsitration/learning is scored on a 24-point scale which has 3 points for registration of 3 words and 21 points for a 3-trial learning of an address. The recall score was drawn from a 10-point scoring which included a 5-min recall of the three items presented previously and 7-point recall of the address. Subjects were required to have depression score on the Hospital Anxiety Depression Scale (HADS) of less than 7, a Clinical Dementia Rating Scale (CDR) of ≤ 0.5, were still functioning independently in the community and should have a normal general cognition (i.e., MMSE > 24). The

standard measures of acquisition (learning) and retention (recall) considered were Malayalam versions of Wechsler Memory Scale-Revised (WMS-R) Logical Memory Test with Story A & B, Rey Auditory Verbal Learning Test (RAVLT)

PROCEDURE IN BRIEF:

The study is to be carried out at Sree Mookambika Institute of Medical Sciences. Relavant clinical and demographic data will be obtained from the patient.

Will document the age/sex/address/clinical information/ symptoms. Predisposing factors and any previous history of treatment /occupation/handedness/

Patient will be administered ACE CHART (Addenbrokes cognitive examination) and will be asked to do certain things. Patient will be made to recall things, identify pictures given in chart, check for verbal fluency, comprehension, repetition of words and assess visuospatial abilities. Based on this score patient will be given marks and the total score is calculated.

STATISTICAL METHODS OF ANALYSIS:

i. Significance level decided before starting of study: $p=\leq 0.05$
ii. Statistical tests to be used for data analysis: Mean, Standard deviation and student t test
iii. Software(s) used for statistical analysis: SPSS version 20.0

RESULTS

RESULTS

Age:

The distribution of age in the study population ranges from 51 to 89 years. The mean age of study participants was 63.14 years and a SD of 9.152 years.

Table 3. Distribution according to age of participants

Age characteristics (years)	**Values (N=100)**
Minimum	51
Maximum	89
Mean	63.14
Standard deviation	9.152

Table 4. Distribution according to age group of participants

Age group	Frequency	Percentage
50-59	44	44
60-69	34	34
70-79	16	16
80-89	6	6
Total	100	100

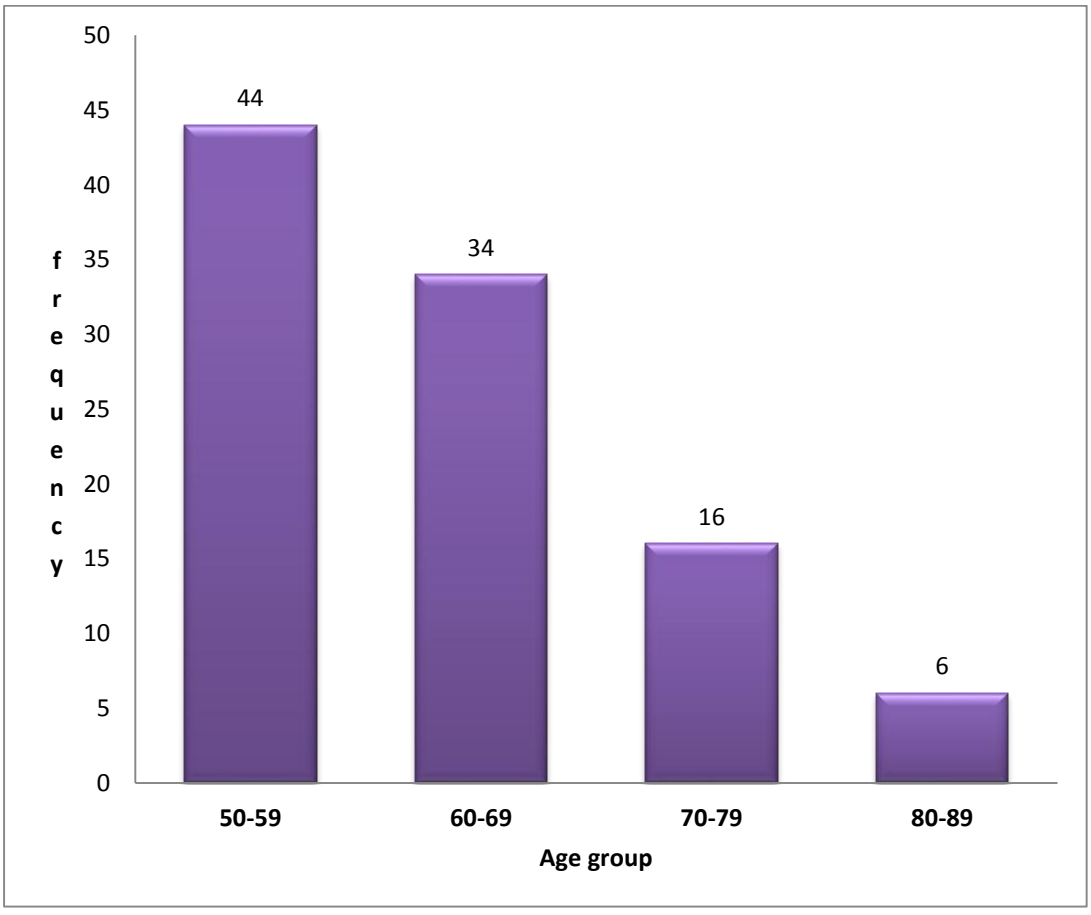

Fig. 2 Distribution of age in the study population

Table 5. Gender

Gender	Frequency	Percentage
Female	49	49
Male	51	51
Total	100	100

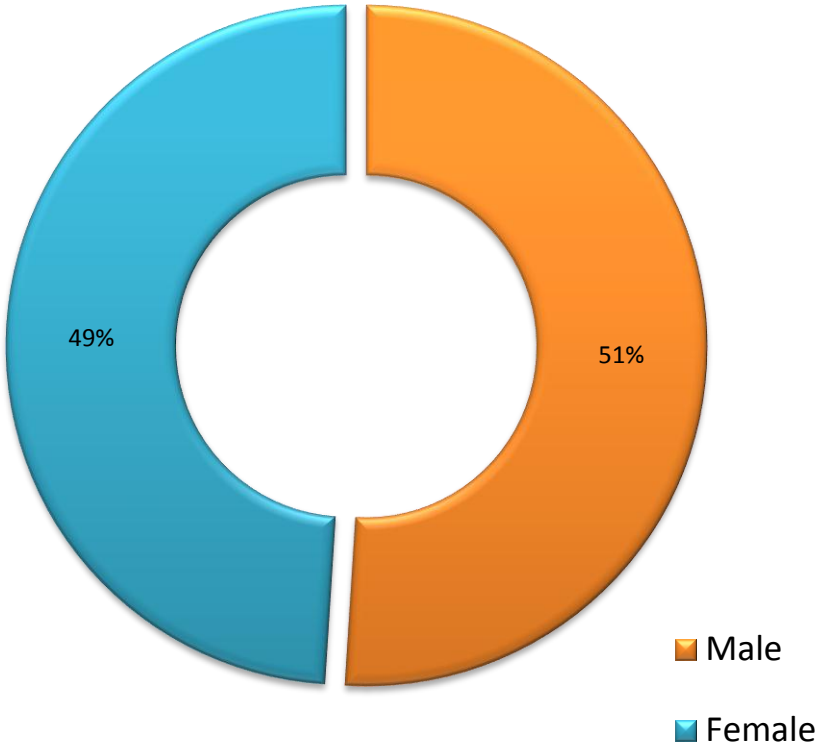

Fig. 3 Distribution of gender in the study population

EDUCATION

Table 6. Distribution according to ACE scoring of participants

Education groups (years)	Frequency	Percentage
1-4	20	20
5-8	36	36
9-12	30	30
>12	14	14
Total	100	100.0

ACE scoring

The distribution of ACE scoring in the study population ranges from 55 to 65. The mean ACE scoring of study participants was 60.47 (95% CI is 60.024, 60.915) and a SD of 2.271.

Table 7. Distribution according to ACE scoring of participants

ACE scoring	Values (N=100)
Minimum	55
Maximum	65
Mean	60.47
Standard deviation	2.271

Comparison of ACE score in age groups

In this study it is found that ACE score is significantly differ between different age groups ($p<0.05$)

Table 8. Comparison of ACE score in age groups

Age group	Mean	Std. Deviation	Minimum	Maximum
50-59	61.4318	2.27624	57	65
60-69	60.3824	1.74103	57	64
70-79	58.8750	1.89297	56	62
80-89	58.1667	2.04124	55	61
Total	60.4700	2.27172	55	65

Table 9. Comparison of ACE score in age groups

ANOVA Table

	Sum of Squares	df	Mean Square	F	p value
Between Groups	113.502	3	37.834	9.139	0.000^{***}
Within Groups	397.408	96	4.140		
Total	510.910	99			

Comparison of ACE score in educational groups

In this study it is found that the difference in ACE score between different educational groups are highly significant ($p<0.05$)

Table 10. Comparison of ACE score in educational groups

Educational groups	Mean	Std. Deviation	Minimum	Maximum
1-4	58.2500	1.65036	55	61
5-8	59.5000	1.18322	57	62
9-12	61.6667	1.53877	59	64
>12	63.5714	1.55486	61	65
Total	60.4700	2.27172	55	65

Table 11. Comparison of ACE score in educational groups

ANOVA Table

	Sum of Squares	df	Mean Square	F	p value
Between Groups	310.065	3	103.355	49.402	0.000^{***}
Within Groups	200.845	96	2.092		
Total	510.910	99			

Table 12. Distribution of scores in different age group

	Minimum score	Maximum score	Overall (mean ± SD)	Age group (in years) (mean±SD)			
				50-59	60-69	70-79	80-89
ACE score	55	65	60.47 ± 2.27	61.43 ± 2.27	60.38 ± 1.74	58.87 ± 1.89	58.16 ± 2.04
Orientation	5	9	7.08 ± 1.11	7.09 ± 1.23	7.12 ± 1.03	7.19 ± 1.10	6.50 ± 0.54
Attention	1	3	1.54 ± 0.52	1.59 ± 0.49	1.5 ± 0.56	1.56 ± 0.51	1.33 ± 0.51
Concentration	1	4	1.93 ± 0.82	1.8 ± 0.85	2.09 ± 0.75	2.06 ± 0.92	1.67 ±0.51
Memory	1	2	1.38 ± 0.48	1.32 ± 0.47	1.38 ± 0.49	1.5 ± 0.51	1.5 ± 0.54
Antero grade memory	7	15	10.18 ± 1.69	10.16 ±1.65	10.41 ±1.87	9.88 ± 1.62	9.83 ±1.16
Retro grade memory	1	3	1.74 ±0.747	1.73 ± 0.75	1.79 ± 0.77	1.81 ± 0.75	1.33 ±0.51
Verbal fluency	5	9	6.83 ± 1.05	6.82 ± 1.16	6.76 ± 0.95	6.81 ± 1.10	7.33 ±0.51
Language	5	8	6.4 ± 0.89	6.41 ± 0.92	6.38 ±0.92	6.44 ± 0.81	6.33 ±1.03
Comprehension	1	2	1.02 ± 0.14	1± 0	1.06 ± 0.23	1± 0	1± 0
Comprehension complex grammar	1	1	1±0	1±0	1±0	1±0	1±0
Repetition single words	1	2	1.42 ± 0.49	1.45 ± 0.5	1.35 ± 0.48	1.5 ± 0.51	1.33 ±0.51
Repetition phrases	0	1	0.53 ± 0.50	0.61 ± 0.49	0.5 ± 0.5	0.44 ± 0.51	0.33 ±0.51
Reading regular	0	1	0.44 ± 0.49	0.48 ± 0.5	0.38 ± 0.49	0.44 ± 0.51	0.5 ± 0.54

Reading irregular	1	1	1±0	1±0	1±0	1±0	1±0
Writing	1	1	1±0	1±0	1±0	1±0	1±0
Visuospatial abilities	1	1	1±0	1±0	1±0	1±0	1±0
Clock	2	3	2.46 ±0.5	2.52 ±0.5	2.44 ±0.5	2.38 ±0.5	2.33 ±0.51
Perceptional abilities	2	4	2.82 ±0.73	2.93 ±0.75	2.76 ±0.69	2.75 ±0.77	2.5 ±0.54
Recall	5	7	5.93 ±0.74	6.02 ±0.73	5.85 ±0.74	5.88 ±0.8	5.83 ±0.75
Recognition	3	5	4.18 ±0.77	4.09 ±0.83	4.35 ±0.69	4.06 ±0.77	4.17 ±0.75

Table 13. Distribution of scores in different educational group

	Minimum score	Maximum score	Overall (mean ± SD)	Education groups (in years) (mean±SD)			
				1-4	5-8	9-12	>12
ACE score	55	65	60.47 ±2.27	58.25 ±1.65	59.5 ±1.18	61.66 ±1.53	63.57 ±1.55
Orientation	5	9	7.08 ±1.11	7.75 ±1.07	6.94 ±0.98	7±1.08	6.64 ±1.27
Attention	1	3	1.54 ±0.52	1.55 ±0.51	1.61 ±0.49	1.43 ±0.5	1.64 ±0.63
Concentration	1	4	1.93 ±0.82	1.6 ±0.68	1.89 ±0.85	2.07 ±0.74	2.21 ±0.97
Memory	1	2	1.38 ±0.48	1.45 ±0.51	1.31 ±0.46	1.43 ±0.5	1.36 ±0.49
Antero grade memory	7	15	10.18 ±1.69	9.3 ±1.75	10.47 ±1.63	10.47 ±1.59	10.07 ±1.73
Retro grade memory	1	3	1.74 ±0.747	1.6 ±0.75	1.81 ±0.71	1.8 ±0.76	1.64 ±0.84
Verbal fluency	5	9	6.83 ±1.05	6.8±1.1	6.86 ±1.01	6.73 ±1.01	7±1.24
Language	5	8	6.4 ±0.89	6.55 ±0.94	6.42 ±0.87	6.47 ±0.9	6±0.87
Comprehension	1	2	1.02 ±0.14	1±0	1.03 ±0.167	1.03 ±0.18	1±0
Comprehension complex grammar	1	1	1±0	1±0	1±0	1±0	1±0
Repetition single words	1	2	1.42 ±0.49	1.4±0.5	1.47±0.5	1.4±0.49	1.36 ±0.49
Repetition phrases	0	1	0.53 ±0.50	0.4±0.5	0.56±0.5	0.57±0.5	0.57 ±0.51

Reading regular	0	1	0.44 ±0.49	0.4±0.5	0.47±0.5	0.37 ±0.49	0.57 ±0.51
Reading irregular	1	1	1±0	1±0	1±0	1±0	1±0
Writing	1	1	1±0	1±0	1±0	1±0	1±0
Visuospatial abilities	1	1	1±0	1±0	1±0	1±0	1±0
Clock	2	3	2.46 ±0.5	2.3±0.47	2.56±0.5	2.43±0.5	2.5±0.51
Perceptional abilities	2	4	2.82 ±0.73	2.75 ±0.63	2.83 ±0.77	2.9±0.75	2.71 ±0.72
Recall	5	7	5.93 ±0.74	6.05 ±0.75	5.83 ±0.73	5.93 ±0.74	6±0.78
Recognition	3	5	4.18 ±0.77	4.4±0.75	4.03 ±0.77	4.13 ±0.81	4.36 ±0.63

Table 14. Distribution of scores among gender

	Minimum score	Maximum score	Overall (mean ± SD)	Gender (mean ± SD)	
				Male	Female
ACE score	55	65	60.47±2.27	60.62±2.39	60.3±2.15
Orientation	5	9	7.08±1.11	7.02±1.19	7.14±1.04
Attention	1	3	1.54±0.52	1.59±0.53	1.49±0.5
Concentration	1	4	1.93±0.82	1.98±0.86	1.88±0.78
Memory	1	2	1.38±0.48	1.51±0.5	1.24±0.43
Antero grade memory	7	15	10.18±1.69	10.08±1.71	10.29±1.68
Retro grade memory	1	3	1.74±0.747	1.67±0.71	1.82±0.78
Verbal fluency	5	9	6.83±1.05	6.92±1.12	6.73±0.97
Language	5	8	6.4±0.89	6.35±0.89	6.45±0.91
Comprehension	1	2	1.02±0.14	1.04±0.19	1±0
Comprehension complex grammar	1	1	1±0	1±0	1±0
Repetition single words	1	2	1.42±0.49	1.37±0.48	1.47±0.5
Repetition phrases	0	1	0.53±0.50	0.59±0.49	0.47±0.5
Reading regular	0	1	0.44±0.49	0.47±0.5	0.41±0.49
Reading irregular	1	1	1±0	1±0	1±0

Writing	1	1	1±0	1±0	1±0
Visuospatial abilities	1	1	1±0	1±0	1±0
Clock	2	3	2.46±0.5	2.45±0.50	2.47±0.5
Perceptional abilities	2	4	2.82±0.73	2.86±0.72	2.78±0.74
Recall	5	7	5.93±0.74	5.92±0.74	5.94±0.74
Recognition	3	5	4.18±0.77	4.25±0.77	4.1±0.77

Table 15. Distribution of dementia based on orientation

Dementia	Frequency	Percentage
Dementia	65	65
No dementia	35	35
Total	100	100

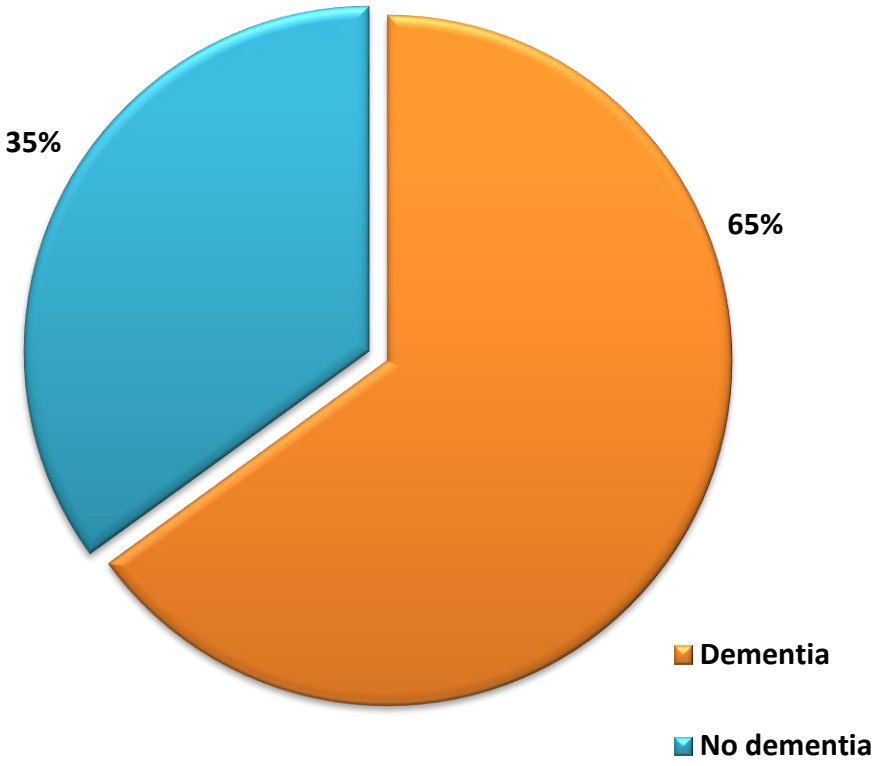

Fig.4 Distribution of dementia based on orientation in the study population

Table 16. Distribution of dementia based on attention

Dementia	Frequency	Percentage
Dementia	47	47
No dementia	53	53
Total	100	100

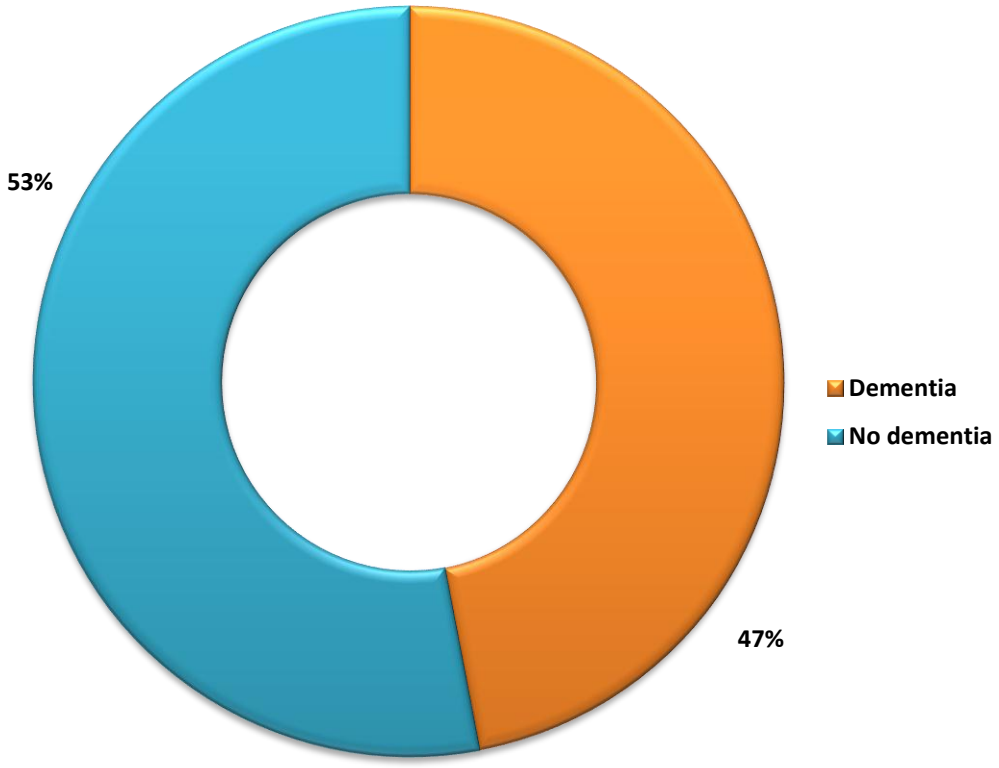

Fig.5 Distribution of dementia based on attention in the study population

Table 17 Distribution of dementia based on concentration

Dementia	Frequency	Percentage
Dementia	33	33
No dementia	67	67
Total	100	100

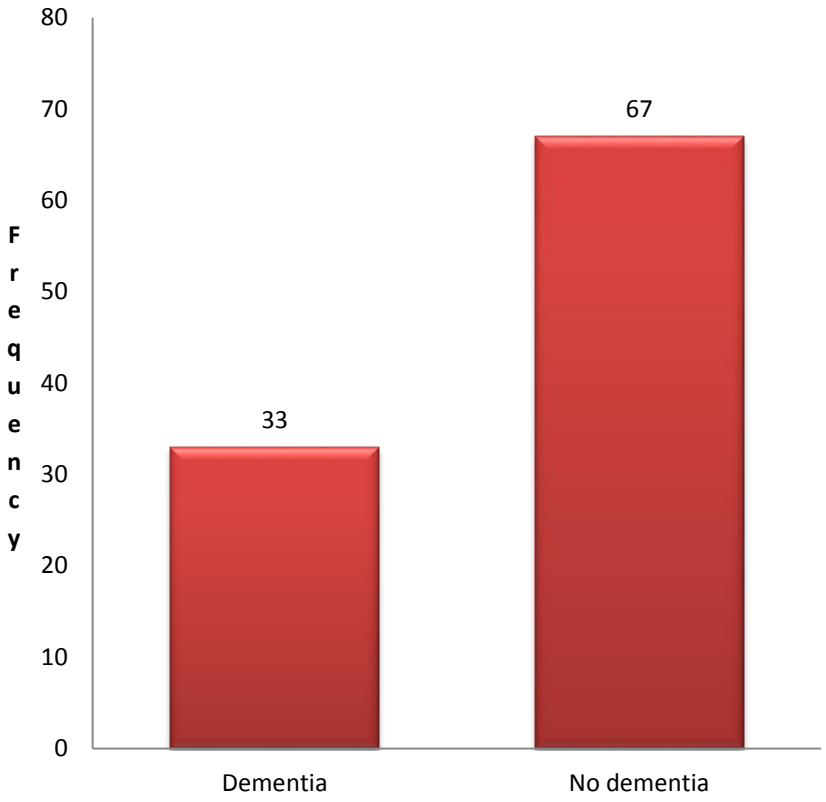

Fig.6 Distribution of dementia based on concentration in the study population

Table 18. Distribution of dementia based on memory

Dementia	Frequency	Percentage
Dementia	62	62
No dementia	38	38
Total	100	100

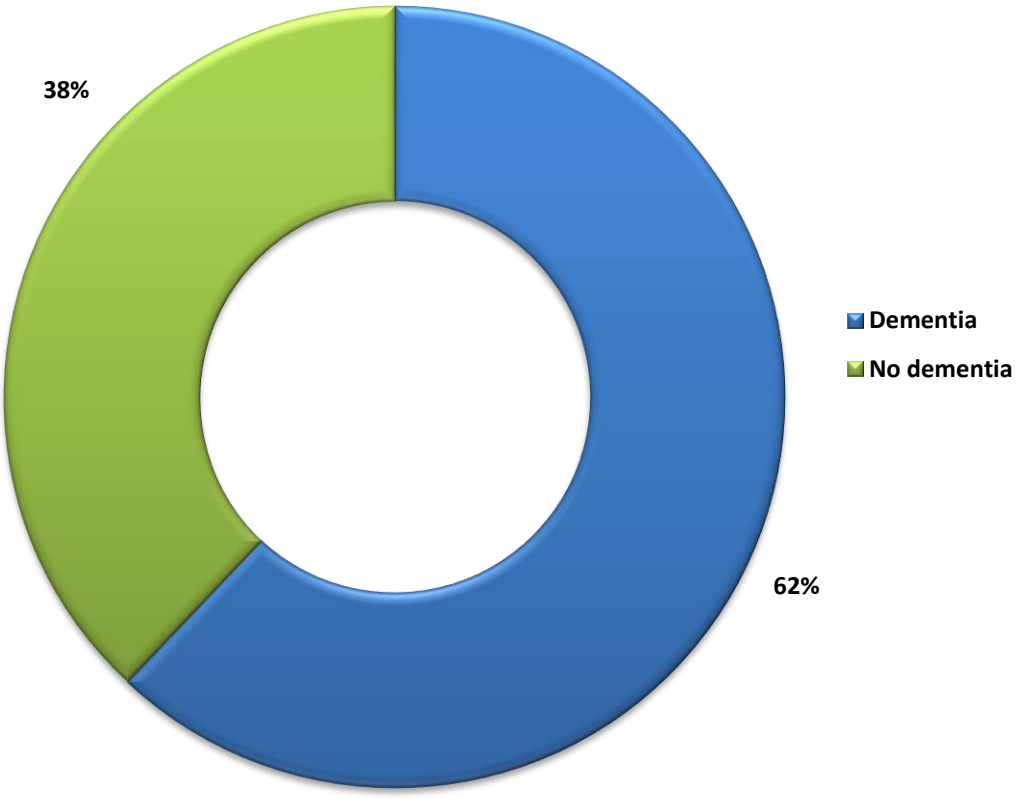

Fig.7 Distribution of dementia based on memory in the study population

Table 19. Distribution of dementia based on anterograde memory

Dementia	Frequency	Percentage
Dementia	56	56
No dementia	44	44
Total	100	100

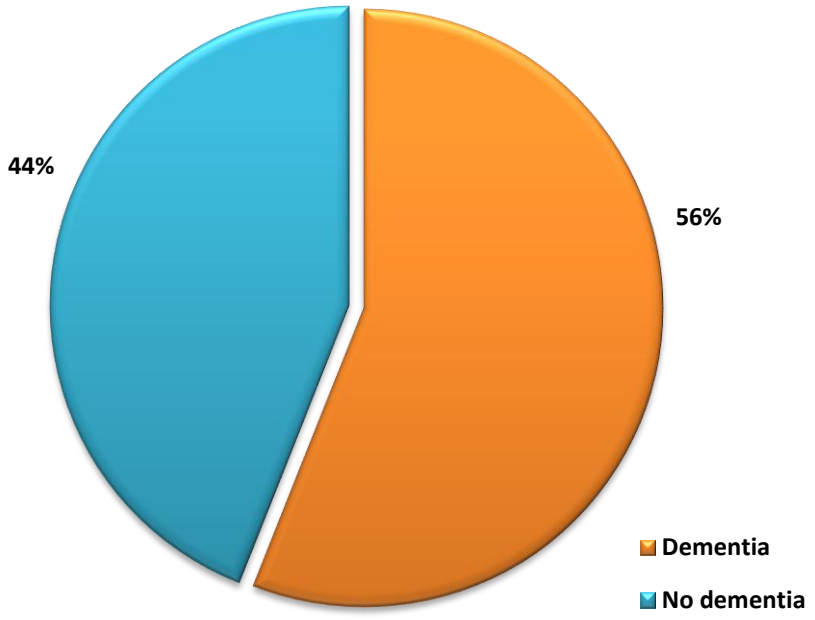

Fig.8 Distribution of dementia based on anterograde memory in the study population

Table 20. Distribution of dementia based on retrograde memory

Dementia	Frequency	Percentage
Dementia	44	44
No dementia	56	56
Total	100	100

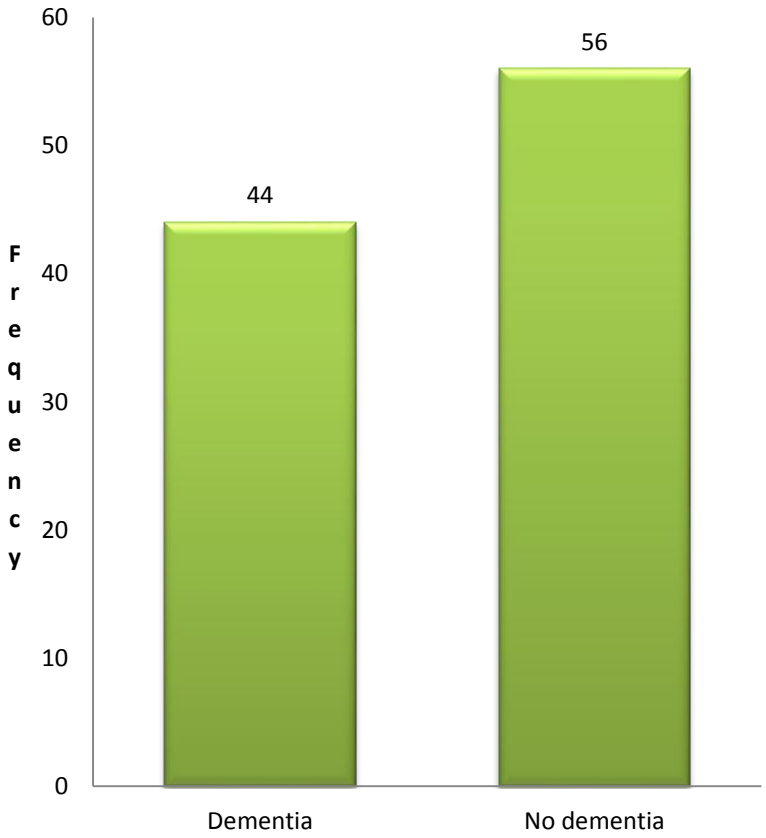

Fig.9 Distribution of dementia based on retrograde memory in the study population

Table 21. Distribution of dementia based on verbal fluency

Dementia	Frequency	Percentage
Dementia	37	37
No dementia	63	63
Total	100	100

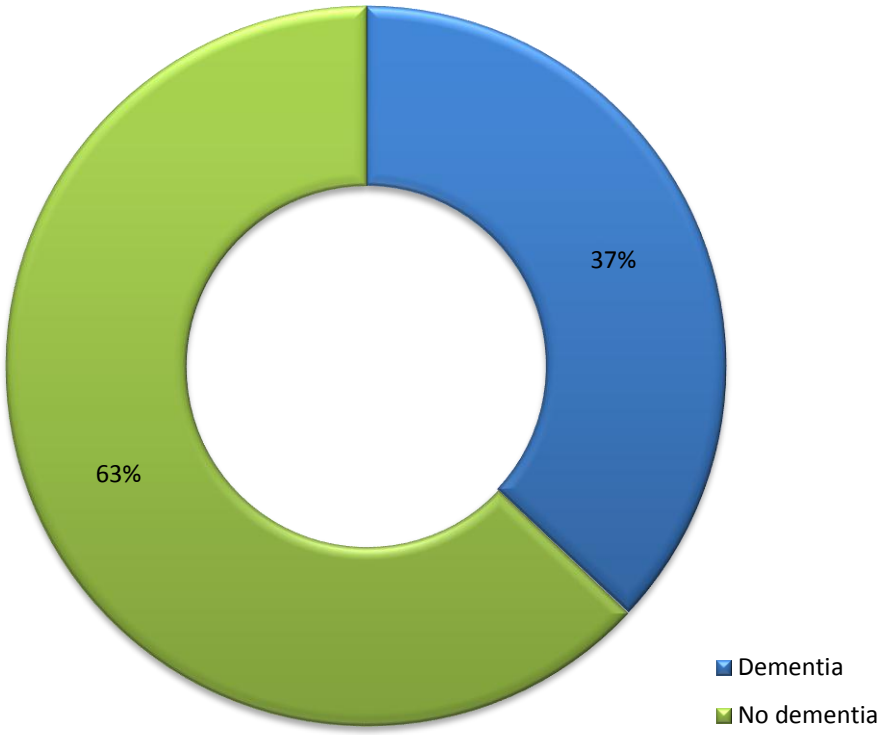

Fig. 10 Distribution of dementia based on verbal fluency in the study population

Table 22. Distribution of dementia based on language

Dementia	Frequency	Percentage
Dementia	54	54
No dementia	46	46
Total	100	100

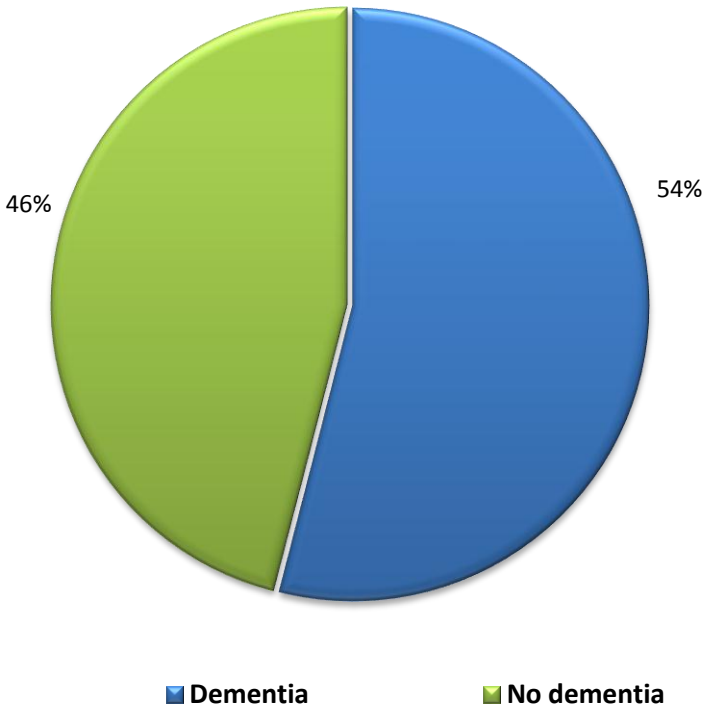

Fig.11 Distribution of dementia based on language in the study population

Table 23. Distribution of dementia based on comprehension

Dementia	Frequency	Percentage
Dementia	98	98
No dementia	2	2
Total	100	100

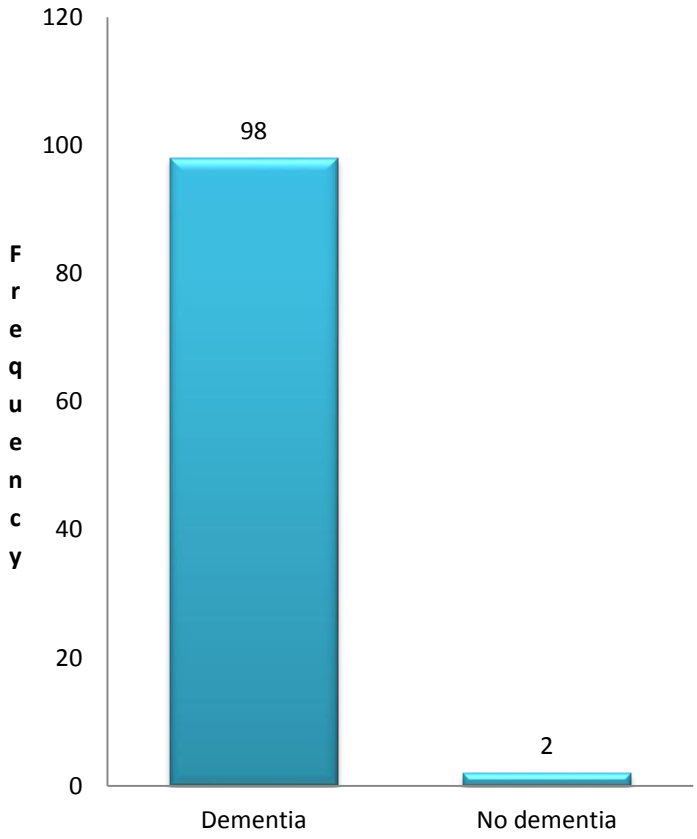

Fig. 12 Distribution of dementia based on comprehension in the study population

Distribution of dementia based on comprehension complex grammar

Based on comprehension complex grammar everyone have dementia (100%) in the study population.

Table 24. Distribution of dementia based on repetition of single words

Dementia	Frequency	Percentage
Dementia	58	58
No dementia	42	42
Total	100	100

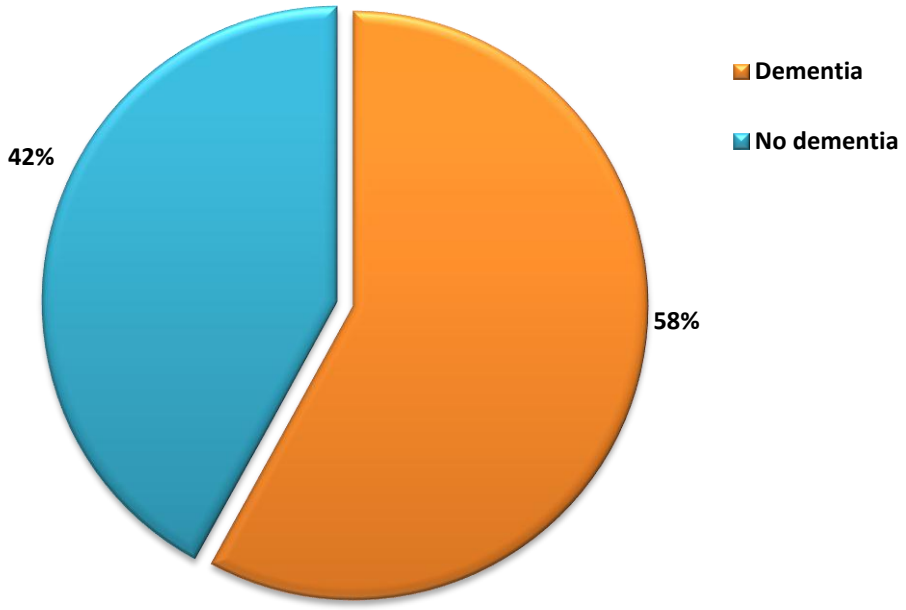

Fig.13 Distribution of dementia based on repetition single words in the study population

Table 25. Distribution of dementia based on repetition of phrases

Dementia	Frequency	Percentage
Dementia	47	47
No dementia	53	53
Total	100	100

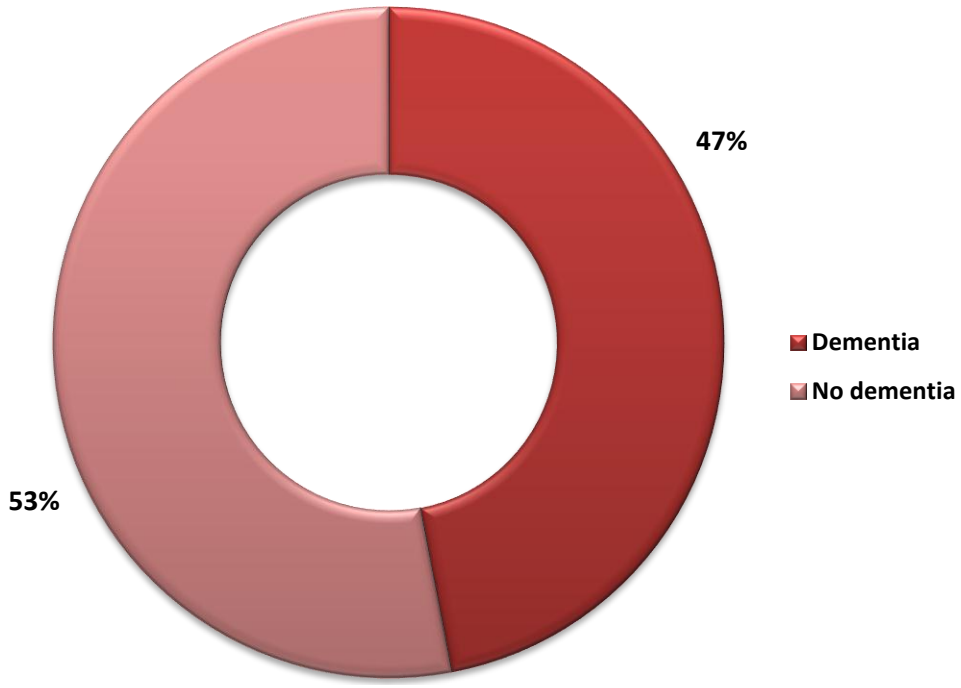

Fig.14 Distribution of dementia based on repetition phrases in the study population

Table 26. Distribution of dementia based on reading regular

Dementia	Frequency	Percentage
Dementia	56	56
No dementia	44	44
Total	100	100

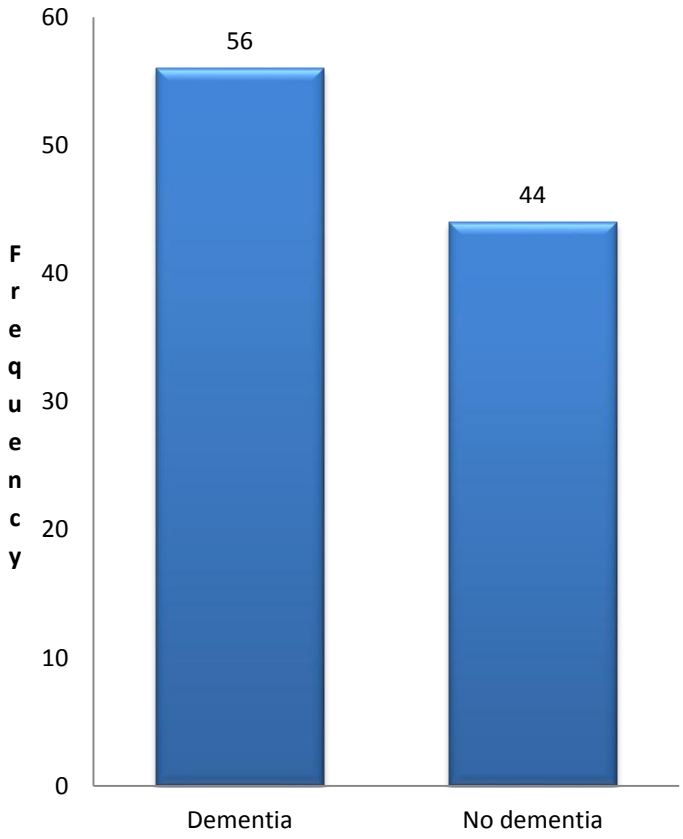

Fig.15 Distribution of dementia based on reading regular in the study population

Dementia based on reading irregular

Based on reading irregular everyone have dementia (100%) in the study population.

Dementia based on writing

Based on writing everyone have dementia (100%) in the study population.

Distribution of dementia based on visuospatial abilities

Based on visuospatial abilities everyone have dementia (100%) in the study population.

Table 27. Distribution of dementia based on clock

Dementia	Frequency	Percentage
Dementia	54	54
No dementia	46	46
Total	100	100

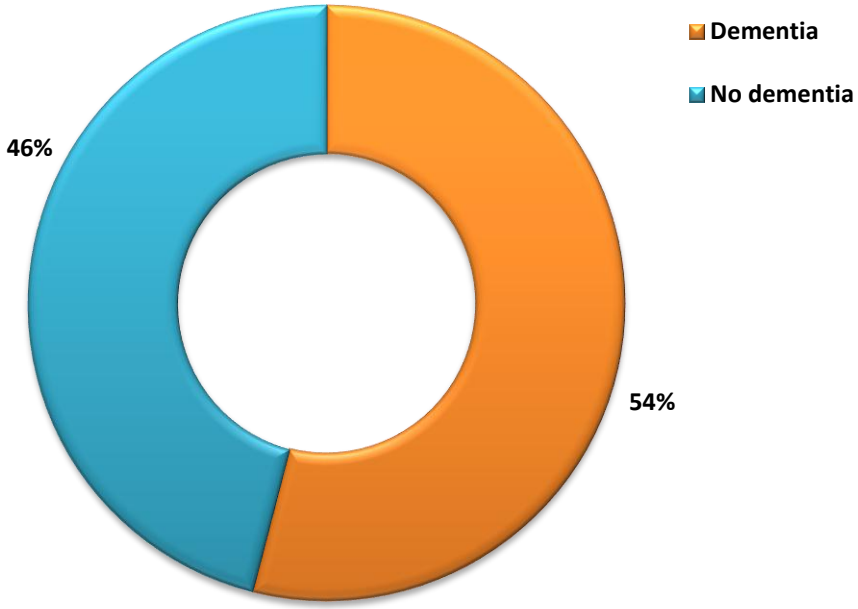

Fig.16 Distribution of dementia based on clock in the study population

Table 28 Distribution of dementia based on perceptional abilities

Dementia	Frequency	Percentage
Dementia	37	37
No dementia	63	63
Total	100	100

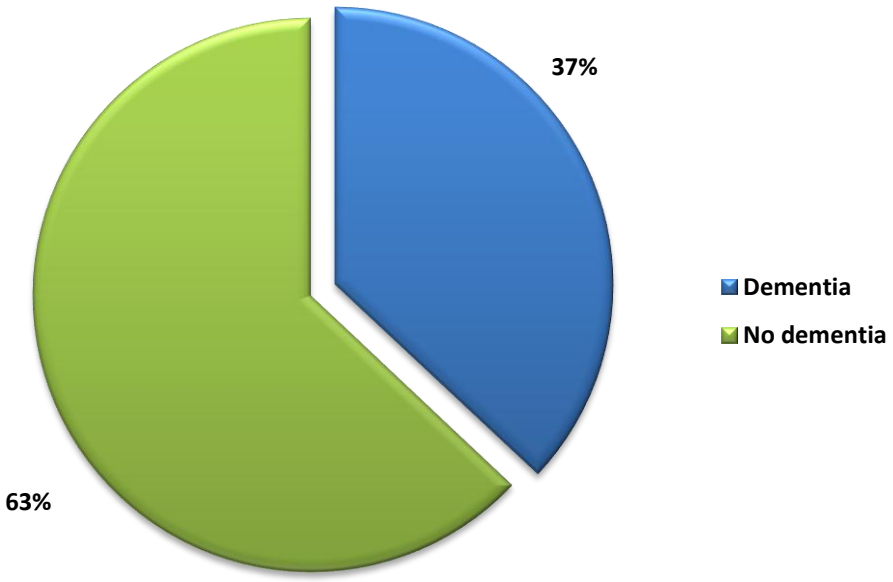

Fig.17 Distribution of dementia based on perceptional abilities in the study population

Distribution of dementia based on recall

Table 29

Dementia	Frequency	Percentage
Dementia	31	31
No dementia	69	69
Total	100	100

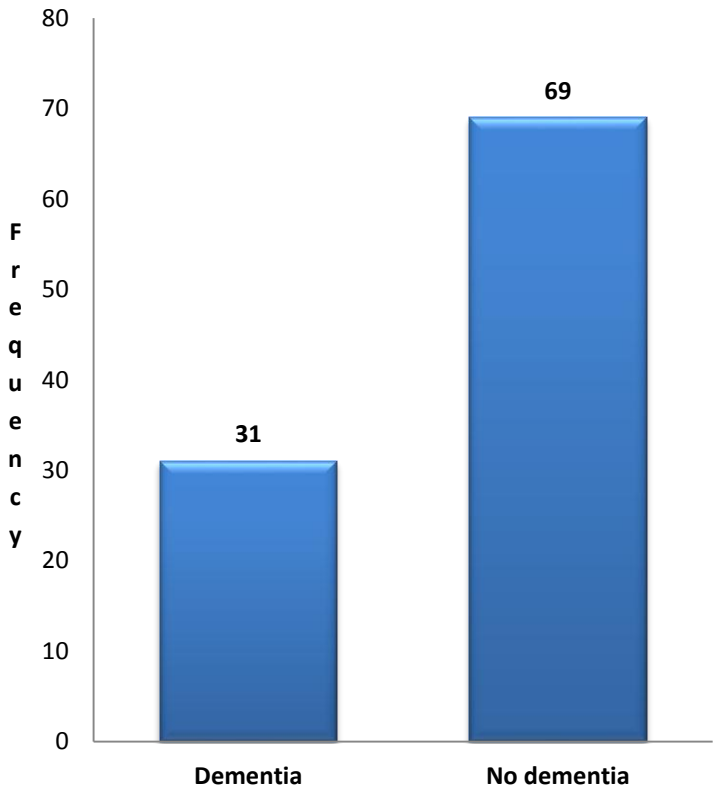

Fig.18 Distribution of dementia based on recall in the study population

Table 30. Distribution of dementia based on recognition

Dementia	Frequency	Percentage
Dementia	60	60
No dementia	40	40
Total	100	100

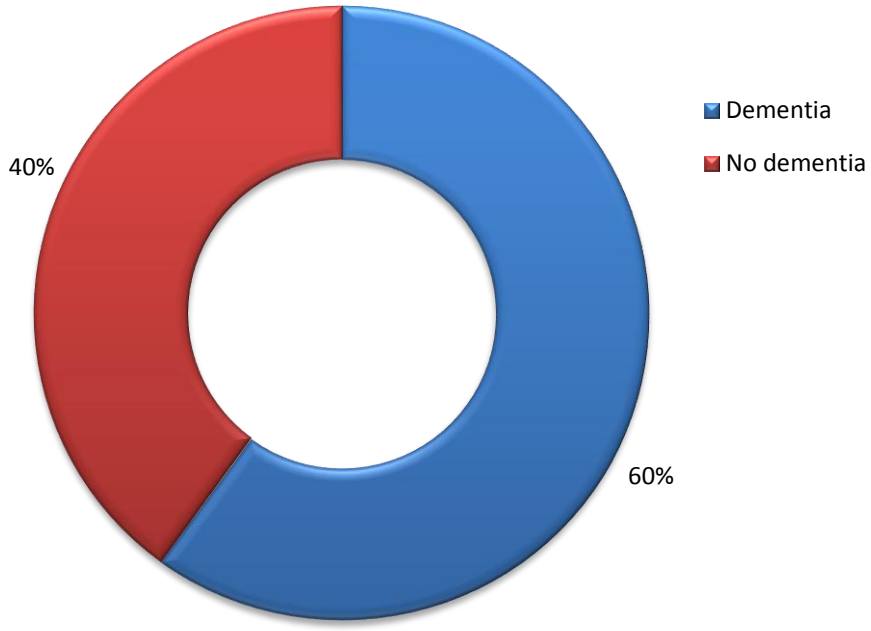

Fig.19 Distribution of dementia based on recognition in the study population

DISCUSSION

DISCUSSION

To adapt and develop the normative value of ACE for Tamil speaking patients.

It is an instrument that defines the normative value of the patients who are not a k/c/o Dementia coming to our college. The ACE instrument developed by me, precisely diagnosed Dementia which the neurologists were not able to diagnose even after a detailed examination and with screening tools. Provided no other instruments for screening Dementia, mine was very precise in the diagnosis.

This screening instrument tends to be cost effective among the Tamil speaking people and it can be easily used and instituted on patients even by the paramedical staffs if they are trained for a short period of time. It can be used as initial screening instrument at the peripheral centres where specialists are not available which may help in prompt referral for further management under the concerned speciality. Being cost effective, it reduces the expenditure for patients and it helps them by making it easy for them to go to the concerned specialists.

All Medicos (MBBS, BAMS, MHW, FHW and Social workers) can institute this screening instrument on the patients to diagnose better and to refer them for faster treatment.

In a Country like India where resources are very less, most of the people belong to the middle class and cannot afford costly investigations.

My study shows:

1. Normative value in all people who were included in the study.
2. It is according to the contribution of age, gender and education.
3. As age increases ACE score comes down.
4. Higher the education higher the ACE score.

These modification of the ACE, translated and adapted in Tamil does not differ a lot from the Malayalam version of ACE and the original ACE.

Cognitive evaluation constitutes as an important tool for the assessment of cerebral functioning, being mandatory for the differential diagnosis between the normal ageing, mild cognitive impairment dementia and its subtypes. ACE includes the assessment of different cognitive domains such as orientation, memory, attention, verbal fluency, language and visuo-spatial ability.

My translated version of the ACE which was used to adapt and develop normative value for Tamil speaking patients, was found to be a promising tool for clinical use and validation in our population.

TRANSLATION INTO TAMIL:

Translation of Malayalam ACE into Tamil ACE was done with the help of linguistic person.

I preferred translating from Malayalam ACE for the following reasons:

- Kulasekharam is a village in the border of state Tamil Nadu between Kanyakumari and Trivandrum.

- Mixture of culture.
- Same food culture.
- Most of the people understand Malayalam and Tamil.
- Things used on a daily basis by the Malayalis are similar to the ones used by the Tamilians.
- The literacy rates between the two places are similar since Kulasekaram was previously a part of Kerala.
- Male and female ratio is also similar to Trivandrum and similar festivals are celebrated in both these areas
- Policy guidelines and administrations are similar in both Trivandrum and Kulasekaram.
- Migration of people between Trivandrum and to areas along the Tamil Nadu borders are very frequent.
- Agricultural techniques followed and the pattern of food grown in this part is similar to Kerala.
- Geographic wise Kulasekaram (Kanyakumari, Tamil Nadu) was a part of Kerala. In 1957, it was divided and included in the state of Tamil Nadu and both the areas are blessed with a rich nature diversity.
- Religion, caste and creed distribution in both these areas tend to be the same.
- Being a tourist place culture practiced in various parts of India can be seen here.

The above mentioned points highlighting the similarities are the reason for me preferring translation from the Malayalam ACE version.

Comparing with the M-ACE study:

Comparing our study to the study conducted by P. S. Mathuranath el al., on Adaptation of the ACE for a Malayalam speaking population in southern India, the mean age group of our population was found to be 63.14years and a SD of 9.152 years. In the study conducted by P S Mathuranath et al., Indian population was compared with UK population. UK population was screened using the ACE original English version. Indian population was screened using the Malayalam ACE (mACE). To establish the equivalence of tests between the m-ACE and the ACE, the Indian cohort was educationally stratified into two groups- 'India >9' (n-50 with education >9) and 'India <8' (n-50 with education <8) so as to allow for an education fair cross-national comparison as UK minimum education years was nine years. Similarly our group was stratified into two educational group- one with <9 years of education and other with >9years of education. The total ACE score of our population was relatively lower than both the Indian and UK population in both educational group. UK population had a mean ACE score of 93.9 whereas mean ACE score of the 'India >9' was 83.6. But chosen population had a lower ACE score of 62.61905. Similarly, 'India < 8' has a mean ACE score of 59.0 comparable to our population with less than 8 years of education with ACE score of 58.875. These differences in Education plays a major role in determining ACE score in both Malayalam speaking population and our Tamil speaking population. Individual components in both the study groups were comparable. Orientation in UK population, 'India >9' group and 'India <8' group was 9.8, 7.8 and 6.4 respectively. So was the results of our population, education more than 9 years and education less than 8 years had scores of 7.345 and 6.82 respectively. Similarly, Verbal

Fluency was much affected in our population compared to the Malayalam speaking population. Mean score of verbal fluency in India>9 of Malayalam speaking population and our population with more than 9 years of education is 9.1 and 6.83 respectively. Whereas the difference in the score was not much high when compared the lower education year population. (7.1 in Malayalam speaking Vs 6.86 in Tamil speaking). In Language, mean score in UK population and Malayalam speaking population is relatively higher than that of Tamil speaking population with education more than 9 years. (15.8 and 15.9 out of 16 Vs 6.83 out of 10).

COMPARISON WITH OTHER STUDIES:

On comparing the separate sub score values with the study of Carvalhov et al., age influenced the verbal fluency sub-scores. With lower age group there was a decrease in ACE score (50-59 years, 6.82 Vs 80-89 years, 7.33). Similarly, we obtained a lower sub-scores for ability to draw a clock with increasing age group. (50-59 years, 2.52 Vs 80-89 years, 2.33).

In contrast to our study, which includes relatively higher number of females, the study conducted by Alexopoulos et al., revealed a significantly fewer female participants than healthy controls.

According to the study on the Slovak population, the score range in the patient group it varied from 11- 80 with the mean of 53.87. Age and education were shown to significantly influence the test performance while there was no significant difference between sexes in the obtained score. A significantly different performance was observed between all three age groups where the obtained score tended to decrease with age. A similar effect was also observed in the three

education levels where participants with low education performed significantly lower than participants with high and advanced education, and highly educated people achieved a lower score than advanced educated individuals. Same result was applicable in our study.

DRAWBACKS OF THE STUDY:

Major drawbacks of the study was that it was hospital based. The evaluation was not done on completely normal people as they visited the hospital mainly due to other medical problems. The normal population could not be included because it does not show the uniformity of population of Tamil Nadu. The ACE was mainly applied on the patients who had come for other ailments to diagnose Dementia.

The size of the sample in our study was very confined and small as compared to the other studies and also the other studies were community based ours being hospital based.

- It is hospital based study.
- Not community based.
- Small number of people involved in this study.
- Patients not included from:
    1. SICU
    2. IMCU,
    3. CT-ICU,
    4. ICCU,
    5. Trauma patients,
    6. Head injury cases

7. Patients under drug influence
8. Patients under alcohol.

The Tamil ACE is not yet approved and formally validated. It has to be subjected to exclusive clinimetric evaluation across the various sample of TN population highlighting the need for future research in this regard.

HIGLIGHTS OF THE STUDY:

- With increase of the age ACE score was low.
- Higher the education higher the ACE score in dementia patients.
- Age distribution among our study:

Max- 89, Min-51, Mean- 63.14

- Gender distribution among our study

Male -51, Female-49

- ACE score in our study

Max- 65, Min-55, Mean-60.47

- Our study showed that ACE score significantly differ between different age group ($p<0.05$) of our study.
- Our study showed that 65% patients were diagnosed with Dementia using T-ACE(Tamil version of ACE)
- Attention being one the parameters for the diagnosis of Dementia, our study showed that 47% people had attention deficit.

- Memory being the other parameters for the diagnosis of Dementia, our study showed that 62% people had memory impairment.
- Verbal fluency being the other parameters for the diagnosis of Dementia, our study showed that 63% people had verbal fluency problem (one of the major highlights of the study).
- Visuospatial abilities being the other parameter for the diagnosis of Dementia, our study showed that 54% people had visuospatial problems.
- Recognition being the other parameters for the diagnosis of Dementia, our study showed that 60% people had recognition difficulties.
- Using ANOVA test results were found to be similar between my study and other studies.

Conclusion

CONCLUSION

- Tamil version of ACE is comparable with the original ACE as far as performance in normal elders are concerned.
- ACE score correlates well with education of normal elderly.
- T-ACE correlates well with age of normal elderly.
- Major drawbacks of the study was small sample size and hospital based sampling. Here the study was replicated on larger community based population before it could be applied to the population.

SUMMARY

SUMMARY

- T-ACE appears to be good tool to diagnose Dementia in Tamil speaking patients.
- T-ACE score correlates well with education and age in normal elderly.
- It is cost effective, user friendly and can be instituted by paramedical staff for further referral to the concerned specialist.
- It can be used in the peripheral centres, which lack specialists, hence reducing the expenditure of visiting many hospitals for patients.
- It is a hospital based study and was applied only to a small scale population of Tamil Nadu which remains as the main drawback of the study.
- To be applied to larger population and community to diagnose Dementia.
- This remains as an area for further research and studies, which might enable the clinicians across the state to diagnose Dementia better.

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APPENDIX

APPENDIX – I

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES

KULASEKHARAM

RESEARCH COMMITTEE

CERTIFICATE

This is to certify that The Research Protocol Submitted by DR. BASAVARAJ SHIVAPPA KUMBAR

Faculty / Post Graduate from Department of GENERAL MEDICINE

Titled DEMENTIA SCREENING USING MODIFIED ADDENBROOKE'S COGNITIVE EXAMINATION INSTRUMENT FOR TAMIL SPEAKING PATIENTS AT SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCE'S

is approved by the Research Committee.

Chair Person

Prof. & H.O.D.
Dept. of Bio-Chemistry
Sree Mookambika Institute of Medical Sciences
Kulasekharam 629 161

Convenor

Prof. & H.O.D.
Dept. of Physiology
Sree Mookambika Institute of Medical Sciences
Kulasekharam 629 161

Date :

APPENDIX - II

INSTITUTIONAL HUMAN ETHICS COMMITTEE

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES,
KULASEKHARAM, TAMILNADU

Communication of Decision of the Institutional Human Ethics Committee(IHEC)

SMIMS/IHEC No: 1 /Protocol no: 39 / 2016

Protocol title: DEMENTIA SCREENING USING MODIFIED ADDENBROOKE'S COGNITIVE EXAMINATION INSTRUMENT FOR TAMIL SPEAKING PATIENTS AT SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES
Principal Investigator: Dr.Basavaraj S.Kumbar
Name& Address of Institution: Department of General Medicine Sree Mookambika Institute of Medical Sciences, Kulasekharam ☑ New review ☐ Revised review ☐ Expedited review
Date of review (D/M/Y): 15.12.2016 Date of previous review , if revised application:
Decision of the IHEC: ☑ Recommended ☐ Recommended with suggestions ☐ Revision ☐ Rejected
Suggestions/ Reasons/ Remarks:
Recommended for a period of :one year

Please note*

- Inform IHEC immediately in case of any Adverse events and Serious adverse events.
- Inform IHEC in case of any change of study procedure, site and investigator
- This permission is only for period mentioned above. Annual report to be submitted to IHEC.
- Members of IHEC have right to monitor the trial with prior intimation.

Reneegalgangadhar

Signature of Member Secretary IHEC

SREE MOOKAMBIKA INSTITUTE OF MEDICAL SCIENCES * KULASEKHARAM *
IHEC
Date 21/12/16

APPENDIX – III

TAMIL VERSION OF ACE

ADDENBROOKE'S COGNITIVE EXAMINATION

NAME: _____	HOSP. NO.: _____
D.O.B.: _____	TESTING DATE(S): _____
AGE: _____	EDUCATION (YEARS): _____
Handedness:	Tested in (Language):

ORIENTATION

*Ask the subject the following questions and score a point for each correct answer. Record all errors. *Allow an error of ± 2.* Total Score for Orientation (0 - 10) ☐

1 a) What is the	1) இது என்ன		b) We are in which	2) நாம் இருப்பது	
year	வருடம்?	____	country	எந்த நாடு?	____
season	காலம்?	____	state	மாநிலம்?	____
month	மாதம்?	____	city	நகரம்?	____
date*	தேதி?	____	hospital	மருத்துவமனை?	____
day	எந்த நாள்	____	floor	நிலை?	____

ATTENTION/CONCENTRATION

2 *Tell the subject* **I will name three objects and you have to remember and repeat them after I finish.** *Taking one second for each, say aloud* . lemon, key, ball.
Say them only once and ask the patient to repeat all three. Give one point for each correct answer at first attempt only. If score <3 repeat all three items until the patient learns all 3. Maximum trials allowed = 5.

நான் உங்களிடம் மூன்று பொருட்களின் பெயலைச் சொல்வேன்.
நான் சொல்லி முடித்தவுடன் அதை நீங்கள் நியாபகப்படுத்திக்கொள்ளவும்.
எலுமிச்சை சாவி பந்து Score (0 - 3) ☐
Number of trials administered =

3 *Ask the patient to* **subtract 7 from 100.**
நூறிலிருந்து ஏழை கழிக்கவும்
Step 1 *Give one point only for the right answer (93).*
Step 2 *If the subject's answer is wrong then tell the correct answer.*
Step 3 *Ask the subject to* **now subtract 7 from** *the correct answer* **(93).**
அதிலிருந்து மீண்டும் ஏழை கழிக்கவும் (93).
Repeat steps 1 to 3 for a total of 5 subtractions (93, 86, 79, 72, 65).
Score the total number of correct subtractions
If score <5 then Ask the subject to **Spell 'WORLD' backwards.**

'பரிசோதனை' என்ற வார்த்தையை பின்னிருந்து வாசிக்கவும் 'யானை' என்று சொன்னால் தாங்கள் 'னையா' என்று கூற வேண்டும்.

Score the number of letters in the correct order, e.g., dlorw = 3.
Take score of better of the two tasks. Record errors. Score (0 - 5) ☐

MEMORY

4 *Ask the subject to* **recall the names of the 3 objects learned earlier** *in question 2. Score a point for each correct recall.*
முன்பு நான் சொன்ன மூன்று பொருட்களின் பெயர்களை நியாபகப்படுத்தி கூறவும் Score (0 - 3) ☐

5 *Anterograde Memory: Tell the subject* I will read a name followed by an address and ask you to repeat it when I have finished. *Now read aloud the following name and address which has a total of seven elements in it. Score one point for each element recalled correctly. Regardless of the score after the first trial, repeat the instruction and the task twice in exactly the same way. Record scores for each of the three trials. Record errors.*

நான் கூறும் பெயரையும் முகவரியையும் நியாபகப்படுத்திக் கூறவும்.

		Elements	Trial 1	Trial 2	Trial 3	Delayed
Velayuthan Thambi	வேலாயுதன் தம்பி	2				
42 Kovil Road	42, கோவில் தெரு	3				
Chengammanad	செங்கமநாடு	1				
Elanji	இளஞ்சி	1				
	Total					

Trial 1-3: Score (0 - 21)
Delayed: Score (0 - 7) ☐ M

6 *Retrograde Memory: Score one point for each correct answer to the following questions and record errors.*

Tell me the name of	முழு பெயரை கூறவும்	Score (0 - 4) ☐
the capital of India	இந்தியாவின் தலைநகரம்	_____
the Indian currency	இந்தியாவின் நாணயம்	_____
the Chief Minister of Kerala	தமிழ்நாட்டின் முதலமைச்சர்	_____
the town where Taj Mahal is	தாஜ்மஹால் உள்ள நகரம் எது?	_____

VERBAL FLUENCY

7 *Letter: Ask the patient to* tell me **all the words you can think of, but not people or places, beginning with the letter P.** *Time the subject for 1 minute and record all answers in the space provided below. Error types: perseverations and intrusions.*

'ப' என்னும் எழுத்தில் தொடங்கும் சில வார்த்தைகளைக் கூறவும் இடத்தின் பெயரோ ஒரு நபரின் பெயராகவோ இருக்கக் கூடாது.

8 *Category: In the same way ask the patient to generate and* **now tell the names of as many animals as you can beginning with any letter of the alphabet.** *Time the subject for 1 minute & record all responses in the space provided below. Errors: perseverations and intrusions.*

உங்களுக்கு தெரிந்த மிருகங்களின் பெயர்களைக் கூறவும். அவை எந்த எழுத்திலும் தொடங்கலாம்

P			Animals			Scoring: Raw Score P	Raw Score Animals	Scaled Score
								7
								6
								5
								4
								3
								2
								1

Raw Score = ☐ ☐
Scaled Score = ☐ ☐

Total Scaled Score (0 - 14) ☐ V

LANGUAGE

9 *Observe the subject's spontaneous speech and record the following*

Fluency (phrases > 5 words)

Paraphasic errors (phonemic or semantic)

Word finding difficulties

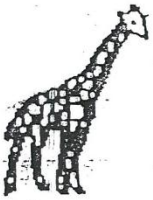
10 *Naming: Show the subject the following two line-drawings and ask him/her to* name each of the these. *Record responses and errors. Give one point for each correct response.*

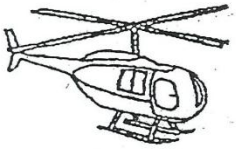
ஒவ்வொன்றின் பெயரைச் கூறவும்

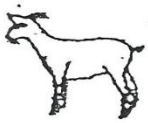
Score (0 - 2) ☐ L

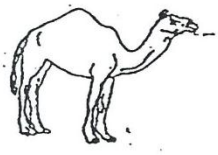
Naming: Show the subject the following ten line-drawings and ask him/her to name each of these. *Record responses and errors. Give one point for each correct response. If response is different from expected then ask them if it resembles anything else.*

ஒவ்வொன்றின் பெயரைச் கூறவும்









Score (0 - 10) ☐ L

11 *Comprehension (one -stage): Request the subject to* obey the following simple commands.

Score (0 - 2) ☐ L

	கீழே கூறும்படி செய்யவும்
point to the door	கதவைச் சுட்டிக் காட்டவும்
point to the ceiling	உச்சவரம்பை சுட்டிக் காட்டவும்
	(உட்கூரை)
	(அடிக்கூரை)

12 *Show the subject the instruction in the box below and ask him/her to* **read this aloud and obey it.**

கீழே கூறப்பட்டுள்ளவையைய நன்பு வாசிக்கவும் பின்பு அதன்படி செய்யவும்.

Score one point if performed correct. Score (0 - 1)☐ L

CLOSE YOUR EYES

கண்களை மூடவும்

13 *Comprehension (3-stages): Give the subject a piece of paper and tell him to* **take this paper in your right / left hand. Fold the paper in half. Then put it on the floor.**

இந்த காகிதத்தை இரண்டாக மடித்து தரையில் போடவும்

Score one point for each correctly performed step Score (0 - 3)☐ L

14 *Comprehension (complex grammar): Request the subject to* **obey the following commands.**

இந்த கட்டளைகளுக்குக் கீழ்ப்படியவும் Score (0 - 2) ☐L

point to the ceiling then the door அடிச்கூரையைச் சுட்டிக் காட்டியபின்னர் கதவைப் பார்க்கவும்.

point to the door after touching the bed/desk/chair கட்டில்/மேஜை/இருக்கையைத் தொட்டபின் கதவைச் சுட்டிக் காட்டவும

Score one point only if entire command is performed correctly .

15 *Repetition (single words): Ask the subject to* **repeat each of these words after me.**

Score one point for each correct repetition. Allow only one repetition Score (0 - 3) ☐L

நான் கூறுவதைத் திரம்பக்கூறவும்

Brown	பழுப்பு
Conversation	உரையாடல்
Articulate	தெளிவாக உச்சரி

16 *Repetition (phrases): Ask the subject to* **repeat each of these phrases after me.**

நான் கூறுவதைத் திரம்பக்கூறவும்

Score one point for each correct repetition. Allow only one repetition.

No ifs, ands or buts Score (0 - 1)☐ L

அவர் இங்கே வருந்திருந்தால் நான் அவரை பார்த்திருப்பேன்

The orchestra played and the audience applauded Score (0 - 1) ☐L

சாக்குப்போக்குகள் சொல்லாதே

(eading (regular): Ask the subject to read each of these words aloud *and show him/her the following five words.* Score (0 - 1) [ ] L

கீழே கொடுக்கப்பட்டுள்ளவையை சத்தமாக வாசிக்கவும்.

SHED	சிற்து / கொட்டாரம்
WIPE	துடை
BOARD	பலகை
FLAME	சுடர்
BRIDGE	பாலம்

18 *Reading (irregular): Ask the subject to read each of these words aloud and show him/her the following five words.* Score (0 - 1) [ ] L

கீழே கொடுக்கப்பட்டுள்ளவையை சத்தமாக வாசிக்கவும்.

SEW	தை / கண்டிப்பு
PINT	ஒர் திரவ அளவு
SOOT	புகைக்கரி
DOUGH	பிசைந்த மாவு
HEIGHT	உயரம்

19 *Writing: Ask the patient to* make up a sentence and write it down in the space below. *If stuck, suggest a topic e.g. weather, journey. Score one point if the sentence has a correct subject and verb and is meaningful.*

கீழே அர்த்தமுள்ள ஒரு வாக்கியம் எழுதவும். Score (0 - 1) [ ] L

_____

_____

20 *Now to check delayed recall ask the subject* Can you tell me the name and address that I had told you and you had practiced at the beginning of the test. *Record scores and errors as for question 5 in the space provided in question 5 on page 2.*

நான் முன்பு உங்களிடம் கூறிய பெயரையும் முகவரியையும் நியாபகப்படுத்திக் கூறமுடியுமா?

VISUOSPATIAL ABILITIES

21 *Overlapping pentagons and Wire Cube: Show the subject the two figures in the next page and* ask him/her to copy these diagrams in the space provided. Score as follows

For the Overlapping pentagons, score one point if both figures have 5 sides and overlap.

For the Cube, score one point if the figure is correct.

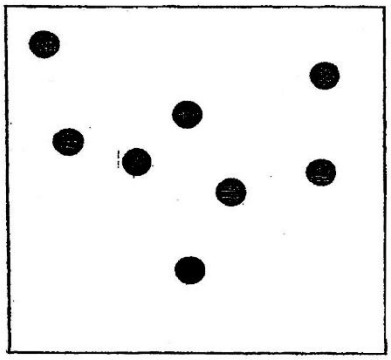
கீழே கொடுக்கப்பட்டுள்ள படங்களை வரைந்து காட்டவும்

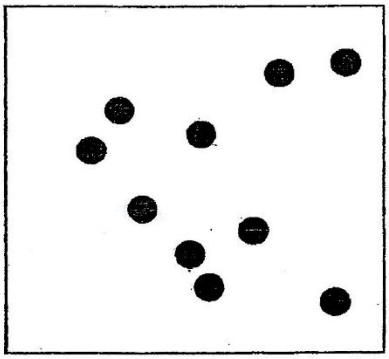
ADDENBROOKE'S COGNITIVE EXAMINATION - ACE-R

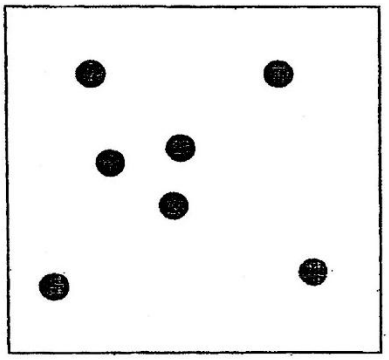
PERCEPTUAL ABILITIES

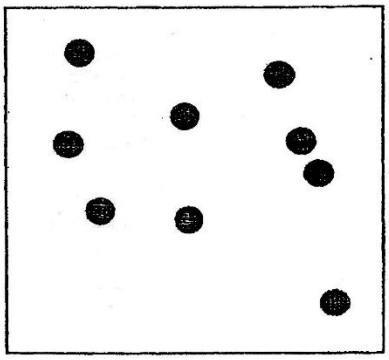
➢ Ask the subject to count the dots without pointing them

[Score 0-4]

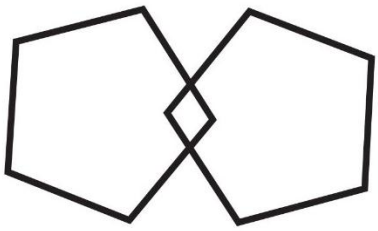


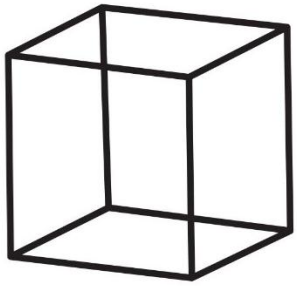






VISUOSPATIAL





Score (0 - 1) ☐

22 *Clock : Ask the patient to* **draw a clock-face with all the numbers and the hands at 5:10**
Score 1 point each for- correct circle, numbering of the clock-face & position of the hands

ஒரு கடிகாரத்தை 5.10 என்று மணி காட்டுவது போல் வரைந்து காட்டவும் Score (0 - 3)

☐

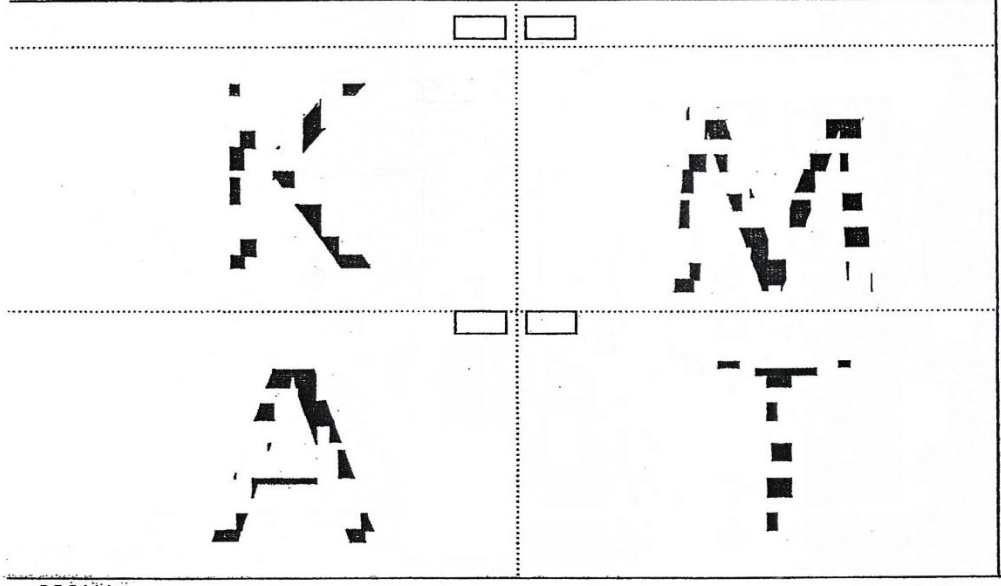
23 *CHECK : Have you recorded the delayed recall for name and address in Q 5 on page 2?*

OVERALL SCORES :						MMSE (0 - 30)
VLOM Ratio	V	+	Sum of L	→	→	
	O	+	M			ACE (0 - 100)
If < 2.2 FTD	If > 3.2 AD					

ADDENBROOKE'S COGNITIVE EXAMINATION - ACE-R

PERCEPTUAL ABILITIES

➢ Ask the subject to identify the letters [Score 0-4]



VISUOSPATIAL

RECALL

➢ Ask Now tell me what you remember of that name and address we were repeating at the beginning"

Harry Barnes 73 Market Street Rockhampton Queensland	....	[Score 0-7]

RECOGNITION

➢ This test should be done if subject failed to recall one or more items. If all items were recalled, skip the test and score 5. If only part is recalled start by ticking items recalled in the shadowed column on the right hand side. Then test not recalled items by telling "ok, I'll give you some hints: was the name X, Y or Z?" and so on. Each recognised item scores one point which is added to the point gained by recalling. [Score 0-5]

Jerry Barne		Harry Barnes		Harry Bradford		recalled	
37		73		76		recalled	
Market Road		Martin Street		Market Street		recalled	
Margate		Rockhampton		Cairns		recalled	
Queensland		New South Wales		Victoria		recalled	

MEMORY

General Scores

MMSE	/30
ACE-R	/100

Subscores

Attention and Orientation	/18
Memory	/26
Fluency	/14
Language	/26
Visuospatial	/16

SCORE

APPENDIX – IV

MASTER CHART

S.NO	IP.NO	GENDER	AGE	ACE SCORING	EDUCATION	ORIENTATION (0-10)	ATTENTION (0-3)	CONCENTRATION (0-5)	MEMORY (0-3)	ANTEROGRADE MEMORY (0-21)	RETROGRADE MEMORY(0-4)	VERBAL FLUENCY (0-14)
1	15026726	M	52	57	5	6	1	2	1	10	2	7
2	15041170	F	56	60	7	7	2	3	2	11	3	6
3	15059413	M	58	56	8	8	2	4	2	12	2	5
4	15062271	F	68	57	6	7	2	2	1	15	3	6
5	15076319	F	70	65	10	9	1	3	2	11	3	6
6	15080997	M	62	65	12	8	1	1	2	12	3	6
7	15095964	F	57	63	GRAUDUATE	6	1	1	2	12	3	5
8	15098128	M	65	62	5	5	1	1	2	11	3	5
9	15107152	M	57	61	TEACHER BSE	5	2	2	2	14	3	5
10	15107234	M	66	56	11	6	2	2	1	13	3	5
11	15110852	M	57	57	4	7	1	3	2	11	2	5
12	15128354	F	63	58	7	8	2	1	1	12	3	6
13	15135105	F	59	59	9	9	1	2	2	11	3	5
14	15136290	F	71	57	11	6	1	3	1	12	2	6
15	15142543	F	57	58	12	5	2	3	1	12	3	5
16	15145324	M	55	56	4	8	1	1	2	11	3	6
17	15146492	M	52	58	2	9	2	1	2	14	3	5
18	15160497	F	62	59	5	7	1	2	2	13	3	6
19	15161172	F	72	60	10	8	2	3	2	13	3	5
20	15167146	F	54	61	LLB	9	2	3	1	11	3	6
21	15170435	M	63	55	7	6	2	2	1	11	2	5
22	15177151	F	55	56	6	8	1	1	1	11	2	6
23	15183055	F	67	64	1	7	1	2	1	11	3	5
24	15192122	F	77	61	ENGINEER	6	2	2	1	11	2	8
25	15197348	M	58	56	9	8	1	2	2	13	2	8
26	15198491	F	54	57	7	9	2	2	1	11	2	7
27	15199251	F	66	65	8	7	2	3	1	14	2	8
28	15209243	M	61	61	9	6	1	3	2	11	2	7
29	15211530	M	56	61	4	8	2	1	1	11	1	8

30	15214979	F	51	56	7	7	2	1	1	11	2	7
31	15217726	F	54	61	11	6	1	2	1	10	1	8
32	15219301	M	60	57	5	8	1	3	2	12	1	8
33	15234692	M	76	58	MBA	7	2	4	2	10	2	6
34	15247330	M	65	59	BARBER 9	7	1	2	1	9	1	7
35	15018287	M	54	60	1	8	2	2	1	9	2	8
36	16039263	F	55	60	3	9	2	3	1	9	1	6
37	16042484	M	71	60	5	9	2	1	1	9	2	8
38	16047212	M	52	62	2	9	2	1	2	9	1	8
39	16061760	M	66	63	4	8	2	2	2	9	2	7
40	16075472	F	67	64	6	8	2	3	1	11	1	7
41	16077209	F	68	64	9	7	1	4	1	12	1	6
42	16085323	M	70	65	8	7	1	3	2	9	1	6
43	16086810	F	53	63	7	8	2	2	1	12	2	8
44	16104478	M	62	55	BSE NURSING	9	3	3	1	11	2	6
45	16113048	M	54	55	6	7	2	4	2	11	1	6
46	16119243	F	51	57	7	6	1	1	1	10	2	5
47	16134828	M	54	56	9	6	2	2	2	10	2	6
48	16135166	M	57	57	11	6	2	2	2	9	2	7
49	16138503	F	66	58	12	6	1	2	1	10	2	7
50	16142258	F	63	58	CKERK 10	7	1	2	1	10	2	8
51	16148107	F	74	63	2	8	2	2	2	10	2	7
52	16148144	M	66	56	3	9	1	2	2	9	2	8
53	16167273	F	69	57	4	7	2	2	2	9	1	7
54	16205154	F	56	58	5	6	1	2	1	10	2	8
55	16214585	M	59	60	7	5	2	1	2	11	2	7
56	16215769	F	63	59	8	7	1	2	2	10	2	8
57	16229043	M	67	64	9	8	2	2	2	13	2	7
58	16241460	F	74	65	10	7	1	2	2	11	2	8
59	17005713	M	69	64	11	8	2	2	2	11	2	7
60	17016159	F	58	60	2	7	1	2	1	10	2	8
61	17016494	M	76	60	3	6	2	1	1	9	1	8
62	17021985	F	88	60	BSE	7	1	1	1	9	1	7
63	17029551	M	58	64	DENTAL	8	2	2	1	8	1	8
64	17033196	F	77	58	BTECH	7	1	1	1	10	1	7
65	17057430	M	54	59	MBA	6	1	1	1	11	1	8
66	17073643	F	51	57	5	6	2	1	1	10	1	7
67	17087014	M	53	56	12	7	2	1	1	11	1	8

68	17093691	F	60	57	5	8	1	1	1	10	2	7
69	17099302	M	80	56	8	7	2	1	2	10	1	7
70	17111652	M	81	56	5	6	1	2	1	11	2	8
71	17123886	M	86	57	9	7	1	2	2	11	1	7
72	17126402	M	82	58	12	6	2	2	1	10	2	8
73	17128476	F	55	57	6	7	2	2	1	10	2	7
73	17129084	M	53	56	8	7	2	2	1	8	1	8
74	17131423	F	57	56	7	6	1	2	1	9	1	7
75	17135011	F	56	64	9	6	1	2	1	8	1	8
76	17135417	M	67	64	7	6	2	2	1	8	1	7
77	17151103	M	60	65	6	7	2	2	1	9	1	8
78	17151131	M	65	56	11	7	1	3	1	9	1	8
79	17168619	M	58	57	TEACHER	6	2	3	1	9	1	9
80	17176885	M	53	58	LLB	6	1	2	1	8	1	8
81	17185485	M	61	56	BA	5	2	3	2	9	1	7
82	17192709	M	69	65	mbbs	6	1	3	2	8	1	8
83	17200260	F	89	63	4	6	1	2	2	8	1	7
84	17201146	F	57	64	7	7	2	1	1	9	1	8
85	17205812	F	65	65	8	8	2	1	1	9	1	7
86	17214874	F	58	57	4	8	2	1	1	7	1	8
87	17216041	F	51	59	9	8	2	1	1	9	1	7
88	17224936	M	54	59	1	9	1	1	1	7	1	6
89	17225253	M	73	60	2	7	1	1	1	7	1	6
90	17229591	F	73	60	12	6	2	2	2	9	1	6
91	17230836	M	77	57	5	6	2	2	2	11	3	9
92	17239152	M	64	58	7	7	1	2	1	8	1	7
93	17241610	F	54	64	9	8	2	1	1	9	1	7
94	17243203	F	76	61	3	9	1	1	1	7	1	7
95	17253082	M	64	62	9	9	1	1	1	9	2	6
96	17254832	M	69	61	11	7	2	2	1	9	1	7
97	17257522	F	52	61	4	6	1	1	1	9	1	6
98	17257545	F	53	63	7	6	1	1	1	7	1	7
99	17265300	F	77	57	8	7	2	2	1	9	2	6
100	18011942	M	67	64	9	6	1	1	1	7	1	6

LANGUAGE (0-10)	COMPREHENSION (0-2)	COMPREHENSION COMPLEX GRAMMAR (0-2)	REPETITION SINGLE WORDS (0-3)	REPETITION PHRASES (0-1)	READING REGULAR (0-1)	READING IRREGULAR (0-1)	WRITING (0-1)	VISUOSPATIAL ABILITIES (0-1)	CLOCK (0-3)	PERCEPTIONAL ABILITIES (0-4)	RECALL (0-7)	RECOGNITION (0-5)
6	1	1	2	1	1	1	1	1	2	2	5	3
5	1	1	1	1	0	1	1	1	3	3	6	4
5	1	1	2	1	0	1	1	1	2	4	7	5
6	1	1	2	0	0	1	1	1	2	2	6	4
6	1	1	1	1	0	1	1	1	2	3	5	5
7	2	1	2	1	0	1	1	1	3	4	7	4
5	1	1	2	1	1	1	1	1	3	2	7	5
6	2	1	1	1	1	1	1	1	3	3	7	3
6	1	1	1	1	1	1	1	1	2	3	6	4
7	1	1	1	1	0	1	1	1	2	3	5	3
5	1	1	1	0	1	1	1	1	2	3	5	4
6	1	1	1	0	0	1	1	1	3	4	6	5
7	1	1	2	1	1	1	1	1	2	2	7	4
6	1	1	1	0	0	1	1	1	2	4	6	3
7	1	1	2	0	0	1	1	1	3	3	7	4
8	1	1	2	1	1	1	1	1	3	4	6	5
7	1	1	1	1	0	1	1	1	2	3	7	3
6	1	1	1	0	1	1	1	1	3	2	6	4
7	1	1	2	0	1	1	1	1	2	4	6	5
7	1	1	1	0	0	1	1	1	3	3	7	4
7	1	1	1	1	1	1	1	1	2	2	7	5
6	1	1	1	0	1	1	1	1	3	3	6	3
7	1	1	1	0	0	1	1	1	2	2	7	4
6	1	1	1	1	0	1	1	1	3	3	7	4
6	1	1	1	1	1	1	1	1	3	4	6	5
6	1	1	1	1	1	1	1	1	2	4	5	3
6	1	1	2	1	0	1	1	1	2	3	7	4
6	1	1	1	0	1	1	1	1	3	3	5	5
7	1	1	2	0	0	1	1	1	3	3	6	5
6	1	1	2	0	0	1	1	1	2	2	5	3
7	1	1	2	1	1	1	1	1	3	2	6	4
6	1	1	1	1	1	1	1	1	2	3	6	5

7	1	1	2	0	0	1	1	1	2	2	7	4
6	1	1	1	0	1	1	1	1	3	3	5	5
7	1	1	1	1	0	1	1	1	3	2	6	5
6	1	1	1	1	0	1	1	1	2	3	6	3
7	1	1	2	1	1	1	1	1	3	4	5	4
7	1	1	2	1	0	1	1	1	3	4	7	3
6	1	1	1	1	1	1	1	1	2	3	6	4
7	1	1	2	1	0	1	1	1	3	4	5	4
8	1	1	1	1	0	1	1	1	2	3	6	5
7	1	1	1	1	0	1	1	1	3	2	5	3
8	1	1	2	1	0	1	1	1	3	3	7	5
8	1	1	2	1	1	1	1	1	2	3	5	4
7	1	1	1	1	0	1	1	1	2	3	6	4
8	1	1	2	1	1	1	1	1	2	4	6	4
8	1	1	1	1	0	1	1	1	2	2	6	4
7	1	1	1	1	1	1	1	1	3	3	5	3
8	1	1	2	0	0	1	1	1	2	2	5	4
7	1	1	1	0	0	1	1	1	3	2	6	3
8	1	1	2	0	1	1	1	1	2	3	5	4
7	1	1	1	0	1	1	1	1	3	2	6	5
8	1	1	2	0	0	1	1	1	2	2	5	5
7	1	1	1	0	1	1	1	1	2	3	5	4
7	1	1	1	1	0	1	1	1	2	2	6	3
7	1	1	2	1	0	1	1	1	3	2	5	4
7	1	1	1	0	0	1	1	1	2	3	6	3
7	1	1	2	1	0	1	1	1	3	2	6	4
7	1	1	1	1	0	1	1	1	2	2	6	5
6	1	1	1	1	0	1	1	1	2	3	6	5
7	1	1	1	0	1	1	1	1	2	2	5	5
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6	1	1	1	0	0	1	1	1	3	3	6	4
6	1	1	1	1	1	1	1	1	2	2	6	5
6	1	1	1	1	0	1	1	1	3	2	6	5
8	1	1	1	1	1	1	1	1	3	3	5	3

7	1	1	1	0	0	1	1	1	2	2	7	5
6	1	1	1	0	0	1	1	1	3	2	7	5
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6	1	1	1	0	1	1	1	1	3	2	6	4
7	1	1	2	1	0	1	1	1	3	3	5	5
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